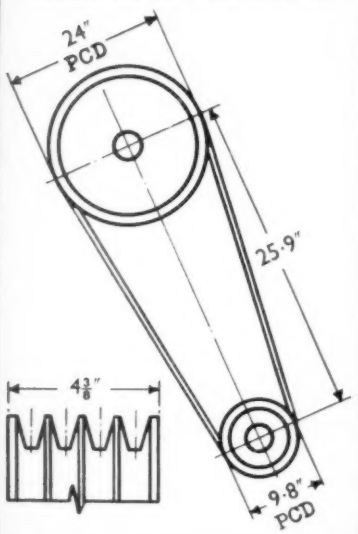
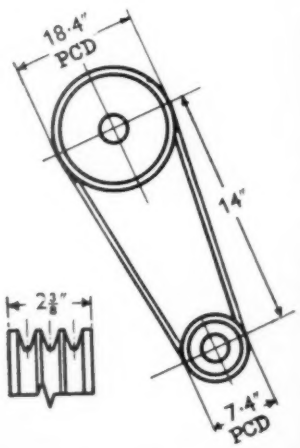
Mechanical World
AND ENGINEERING RECORD
Monthly: Two Shillings and Sixpence NOVEMBER, 1960

CONVENTIONAL V-ROPE DRIVE



ULTIVEE ROPE DRIVE

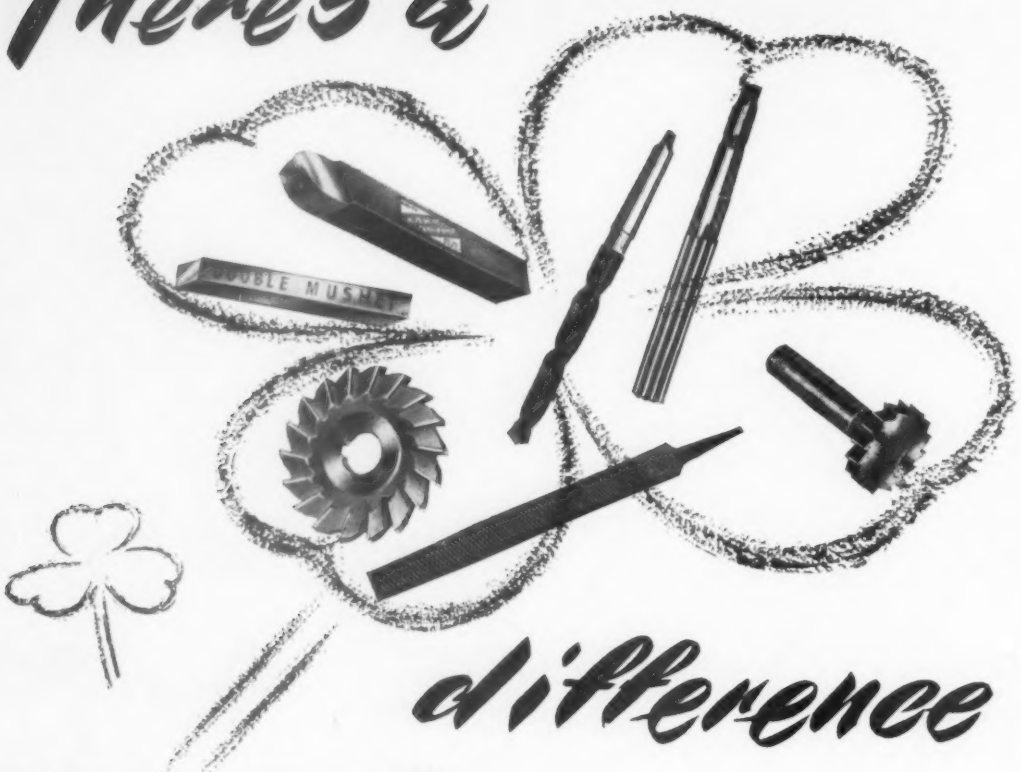


SEE HOW CROFTS ULTIVEE ROPE DRIVES CUT COSTS, SAVE SPACE!

Crofts Ultivee Rope Drives transmit more power in less space, cutting the number of ropes as much as 40% and permitting smaller pulley diameters and face widths with shorter centre distances—the weight of the whole drive is thus reduced. Only three sections of ropes in a large range of lengths are used (the two smaller sections covering the majority of industrial requirements) and a standardised range of pulleys is available.

Crofts

There's a



difference

Top quality may not be quite so rare as the four-leaf clover, but be sure of obtaining the best by specifying *Osborn* engineers' cutting tools. The range available includes almost every type of engineers' cutting tool, and these are manufactured throughout, from steelmaking to finished product, within the same organisation.

☆*Comprehensive stocks constantly maintained*

MUSHET BRANDS
ENGINEERS' CUTTING TOOLS

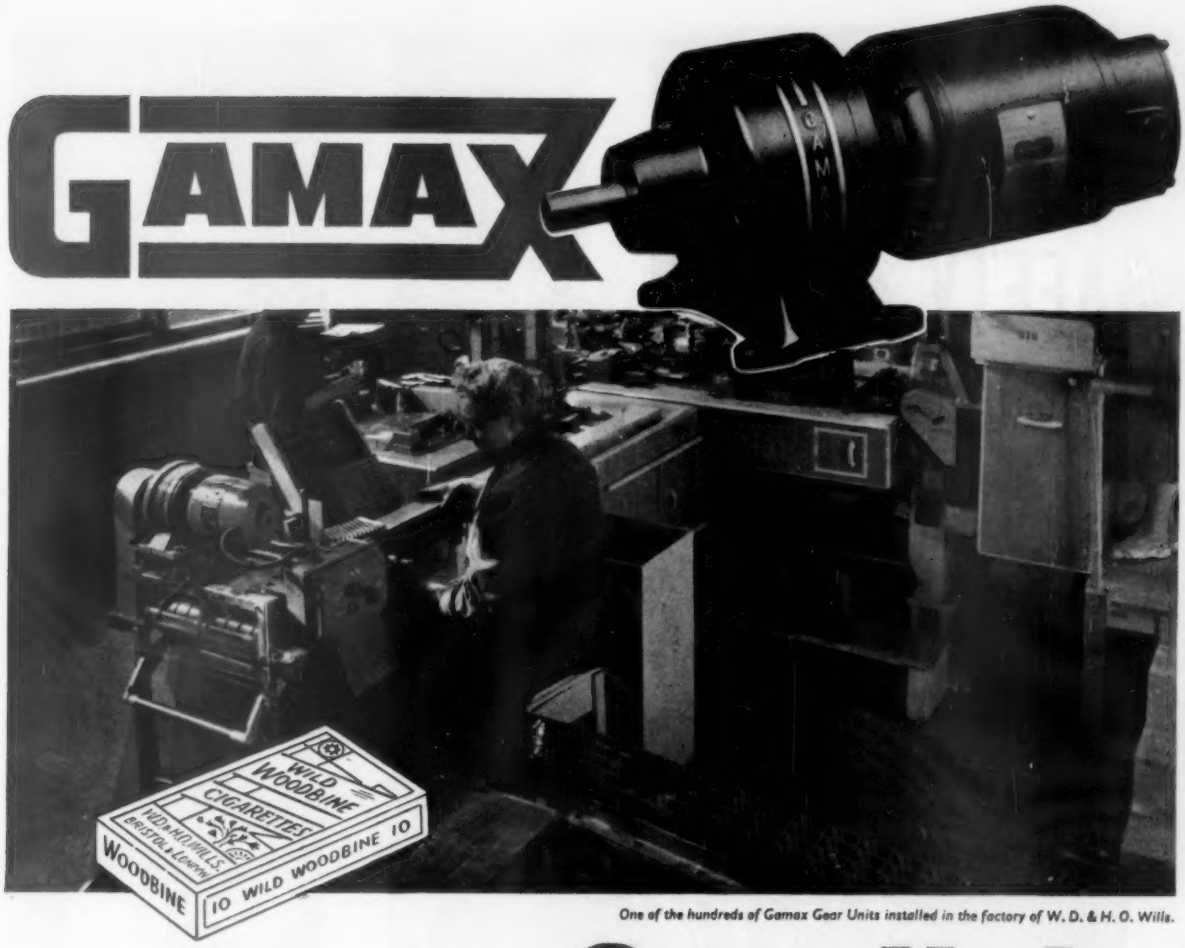
- *Twist Drills*
- *Reamers*
- *Milling Cutters*
- *'Titanic' chucks*
- *Lathe and Planer Tools*
- *Toolholder Bits*
- *Hand Chisels*
- *Pneumatic Snaps and Chisels*
- *'Hand and Heart' Files*
- *Hacksaw Blades*
- *Taps and Dies, etc.*

OSBORN

SAMUEL OSBORN & CO., LIMITED
CLYDE STEEL WORKS, SHEFFIELD.

FINE STEELMAKERS · STEELFOUNDERS · ENGINEERS' TOOLMAKERS

GAMAX



One of the hundreds of Gamax Gear Units installed in the factory of W. D. & H. O. Wills.

THE GREAT LITTLE **Gear Unit**

gives smooth, efficient service in light industry

For packaging cigarettes and for almost any other light industrial tasks requiring a range of ½ to 1½ max. H.P. (18–896 r.p.m. output speed) these compact Gamax Gear Units excel. Incorporating straight line drive with high quality Durangus non-metallic planet pinions they provide really silent, vibration-free operation . . . *and because conventional oilbath lubrication is completely dispensed with, all fear of leakage or contamination is eliminated.*

The sealed bearing assembly is prepacked with grease to ensure at least two years trouble free running under normal conditions . . . and these compact units can be mounted at *any* angle without in any way impairing their efficiency.

Competitive in price, these outstanding gear units are available to give efficient, quiet and trouble-free service in any light industrial application.

ALSO IN REGULAR PRODUCTION ARE:—

Spur and Helical Gears up to 78" diameter.
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Worm Gears up to 24" centres.
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Profile Ground Spur, Helical and Worm Gears.
Durangus and Peak Non-metallic Silent Gears.
Rawhide Silent Pinions.

GEAR UNITS OF ALL KINDS TO SPECIAL REQUIREMENTS.

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GEAR DIVISION
PRINCE CONSORT ROAD - HEBBURN CO. DURHAM
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A53/60

SENSIBLE SAFETY

Everybody understands why dangerous animals have to be kept behind bars, and so instances of people being injured by caged wild animals are fortunately rare.

Moving machinery and tools can also inflict serious injury, and it is no less important that these, too, should be securely guarded and fenced.

Safety First with

'HARCO' MACHINERY GUARDS

'Harco' Machinery Guards are purpose made for every type of machinery, and are constructed to afford complete protection without interfering with efficient operation. They are strongly made from stout wire mesh to withstand vibration and rough treatment, and all 'Harco' Guards fully conform to Factory Act requirements. The complete Harvey service covers advice, design and installation, and List No. 996 shows many types already supplied.

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CLASS I WELDED PRESSURE VESSELS TO LLOYD'S AND A.S.M.E. CODES · HEAT TREATMENT AND RADIOGRAPHY · 'ROTARPREST' HEADS FROM 5 FT. TO 15 FT. DIA.—*Larger sizes to specification* · WELDED PRESSURE VESSELS AND FABRICATIONS IN ALL METALS STEEL PLATE AND SHEET METALWORK HEAVY MACHINING AND FITTING PERFORATED METALS · WOVEN WIRE WIREWORK · STEEL STORAGE EQUIPMENT

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WW/3

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E.P.E. turn D.C. problems into D.C. motors* ....

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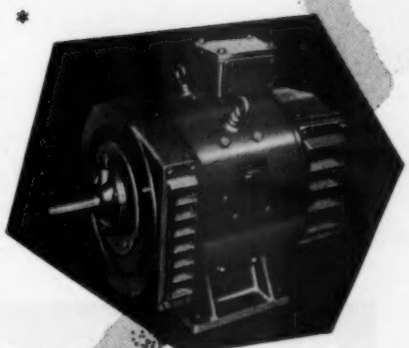
E.P.E. specialise in D.C. equipment, combining their many years experience in this field with a keen interest in new techniques. They can supply D.C. motors and generators of any enclosure quickly and at a reasonable price.

If you've a D.C. motor problem, why not bring it along to E.P.E? If they haven't a solution in stock, they'll be happy to make one for you!



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There's nothing quite like it . . .

. . . that's the beauty of it

Look at these advantages — Light as aluminium. High resistance to wear. Wide range of resistance to chemical attack. Easily machined. High thermal conductivity. Excellent heat radiation. Not wetted by molten metal or slags. Non-seizing. Self-lubricating. High resistance to thermal shock. Good mechanical strength at high temperatures. Good electrical conductivity. Available in impervious forms. Low thermal expansion.

These properties give Morganite Carbon vast potentialities for the design engineer. Talk them over with our technical staff.

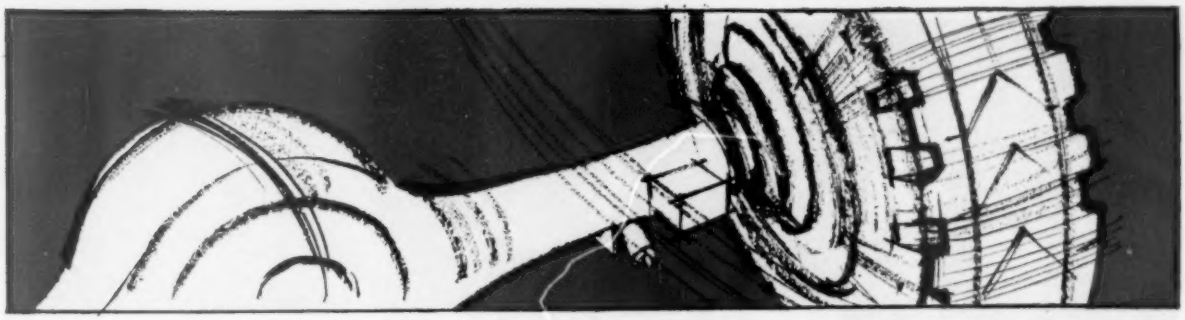
The illustration shows a Rectifier Control Grid, a Rectifier Anode, a Boat, a Bearing, two Gland Rings, a Piston Ring, a Tube and a Valve Anode —just a small selection of products showing the remarkable versatility of Morganite Carbon.

MORGANS

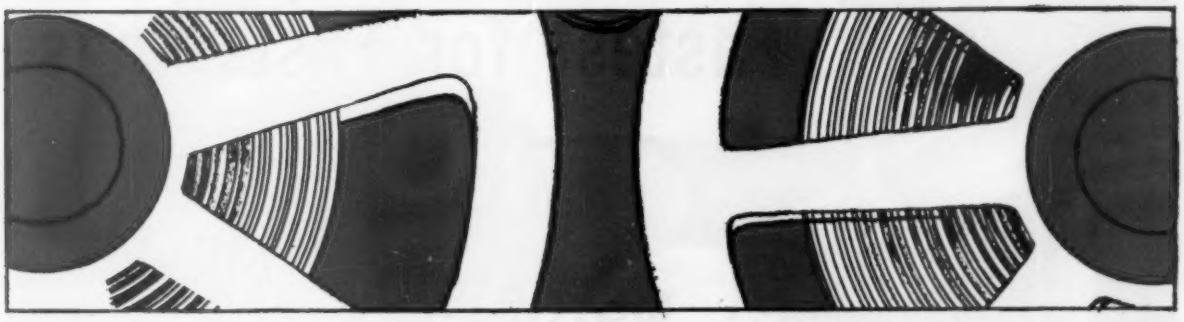
CARBON AND GRAPHITE—ELECTRICAL, CHEMICAL AND MECHANICAL; CRUCIBLES, FURNACES, REFRACTORIES; RADIO PARTS, SINTERED METAL PRODUCTS AND ELECTRIC FURNACE ELEMENTS.

THE CARBON DEPARTMENT,
THE MORGAN CRUCIBLE COMPANY LTD., BATTERSEA CHURCH ROAD, LONDON, S.W.11. **BAT: 8822.**

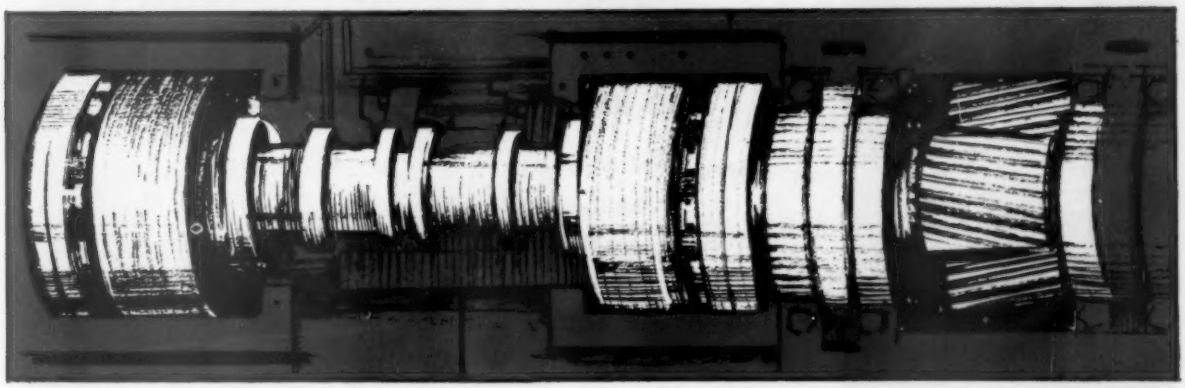
C58A/416



consult R&M bearing experts



when at the prototype stage



As machines grow more complex and performances increase, the selection of bearings becomes more difficult. It requires specialist knowledge.

In increasing numbers, design and development groups are consulting the Technical Department of Ransome & Marles for guidance. Specification as well as supply is part of the R&M service to the engineering industry.

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Ransome & Marles produce ball and roller bearings for most applications.

Publication 37 is a comprehensive guide to the full range.

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RANSOME & MARLES BEARING COMPANY LIMITED

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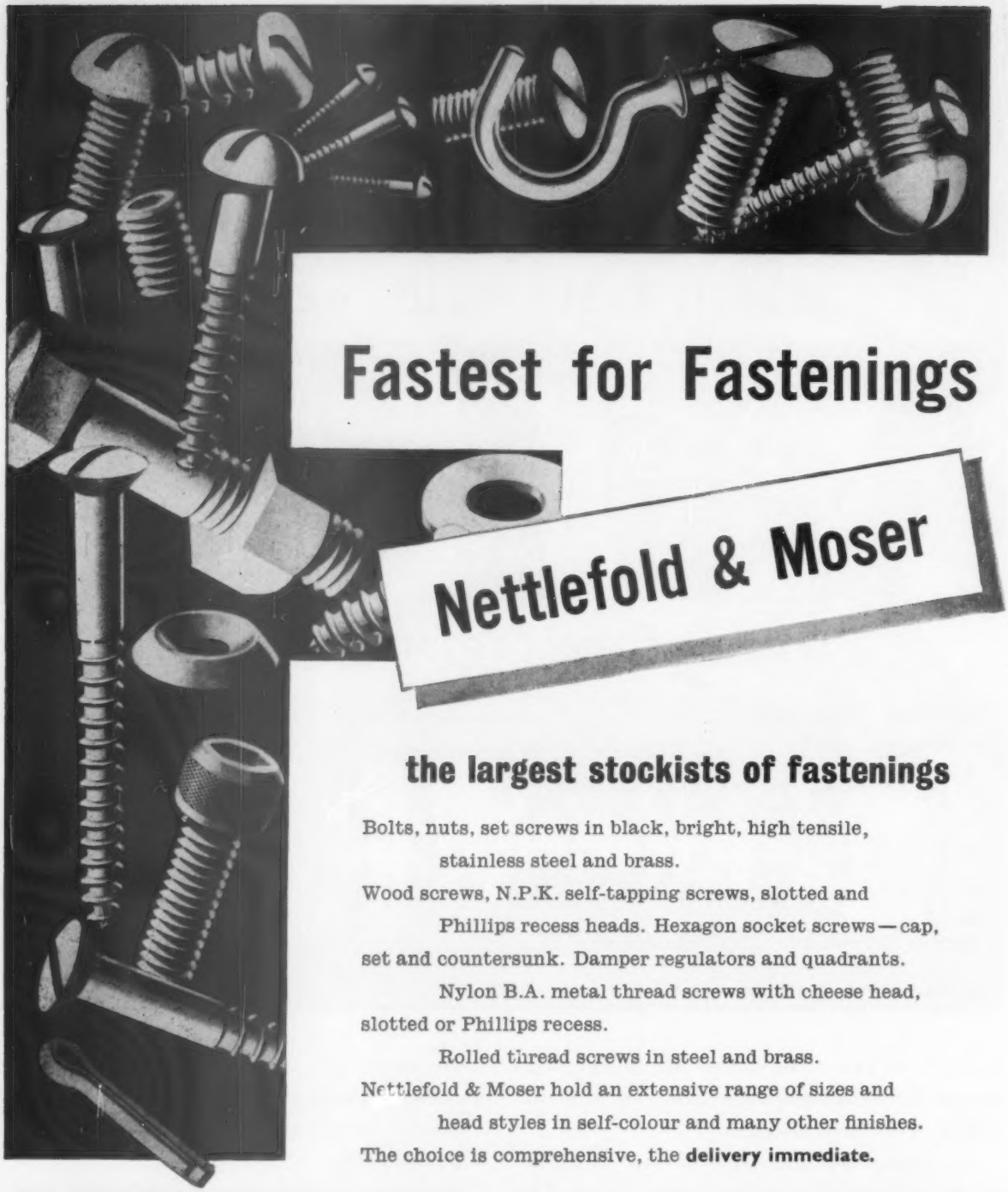

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the largest stockists of fastenings

Bolts, nuts, set screws in black, bright, high tensile, stainless steel and brass.

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Nylon B.A. metal thread screws with cheese head, slotted or Phillips recess.

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Nettlefold & Moser hold an extensive range of sizes and head styles in self-colour and many other finishes.

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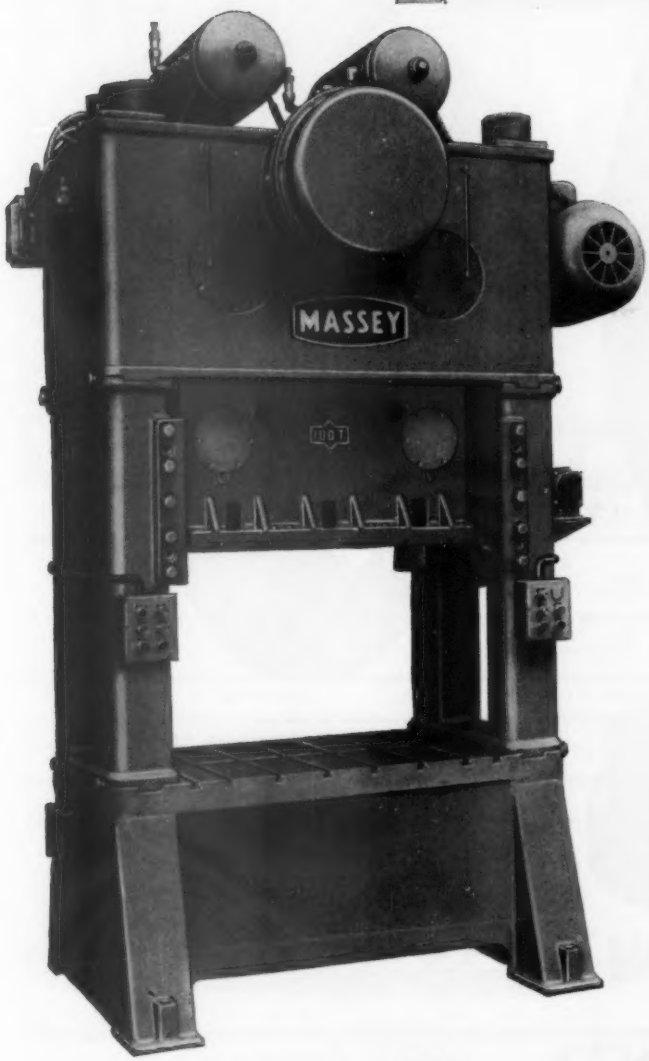
MASSEY

WIDE RAM PRESSES for trimming, setting etc.



Available in sizes from 100 to 1,000 ton, this specially designed multi-purpose press enables pre-forming, setting and straightening to be carried out in addition to trimming and piercing operations. Electrically driven, with transmission through alloy steel double helical gears. Comprehensive lubrication system automatically inter-locked with main press drive. Frame of maximum strength with large diameter tie bolts shrunk into position. Air-operated friction clutch fully protected against overload.

100 Ton Wide Ram Trimming and Setting Press.

MASSEY DESIGNS INCLUDE

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Seamless Rings in Carbon and Alloy Steels. Flanges of all types. Gear Rings and other rings with square, rectangular or profiled cross section, from 6 inches (minimum weight 70 lbs.) to 78 inches inside diameter and from 2 to 12 inches axial width.
Circular Die Forgings, maximum weight 2,000 lbs. Plain or punched slabs and special shaped forgings up to 40 inches diameter.

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Fenner SpacesaVer Wedge-Belt Drives are

SLIMMER, LIGHTER, SHORTER, CHEAPER

- Width and weight now reduced by a half, and cost by at least a fifth, without loss of strength or durability.
- Modern materials and a new belt section give a much greater power capacity. SpacesaVer Wedge-Belts make full use of the strength and flexibility of Terylene cords. These are bonded to a synthetic rubber which keeps them exactly where they can do most work with least stress to themselves. This rubber provides heat and oil resistance and adequate electrical conductivity at no extra charge. New pulley designs take full advantage of modern casting methods to give stronger, yet lighter pulleys. All have Taper-Lock quick and easy fixing facilities.
- Two Wedge-Belt sections, $\frac{3}{8}$" (Alpha) and $\frac{5}{8}$" (Beta) cover all normal drives up to 200 horse-power. Belt lengths and pulley diameters are based on International Standardisation principles. Your complete drive design can be selected from a single line reading in the SpacesaVer catalogue 135/20. Send for it now.

THE GREATEST ADVANCE IN DRIVE DESIGN FOR 30 YEARS

HERE IS THE PROOF

DRIVE		MOTOR PULLEY DIAM.	DRIVEN PULLEY DIAM.	FACE WIDTH	V-BELTS AND WEDGE-BELTS USED	CENTRE DISTANCE	DRIVE LIST PRICE	DRIVE WEIGHT LB.
5 H.P.	V-Belt	$3\frac{3}{4}$	$6\frac{3}{8}$	$3\frac{1}{4}$	5—A29	7·5	£6 · 8 · 7	16·7
	Wedge-Belt	3·15	5·60	$1\frac{1}{2}$	3 Alpha 280	7·1	£5 · 3 · 8	10·6
	SAVING	**16%**	**12%**	**54%**	—	**5%**	**19%**	**36%**
25 H.P.	V-Belt	$6\frac{1}{2}$	$12\frac{1}{2}$	$5\frac{7}{32}$	6—B65	18·7	£17 · 0 · 7	66·8
	Wedge-Belt	5·3	10·6	$2\frac{23}{32}$	6 Alpha 560	15·3	£11 · 11 · 6	36·2
	SAVING	**18%**	**15%**	**48%**	—	**18%**	**32%**	**45%**

SpacesaVer WEDGE-BELT DRIVES

Catalogue 135/20 details drives up to 200 h.p. Send for it ***NOW!***

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THE LARGEST MAKERS OF V-BELT DRIVES IN THE COMMONWEALTH

The all weather drive !

For tough, slow-speed drives which must function in all weathers, specify THE COVENTRY MARK 5 CHAINS. These corrosion-resistant all-steel roller chains ensure long trouble-free service under the most arduous conditions. They will replace malleable and pressed link chains and run on the same wheels.

The Mark 5 chain drive illustrated has been running 14 hours per day for over a year without lubrication, exposed to all weathers and covered in coal and coke grit, and both chain and wheels are still in good condition.

THE COVENTRY MARK 5

STEEL ROLLER CHAINS

RENOLD

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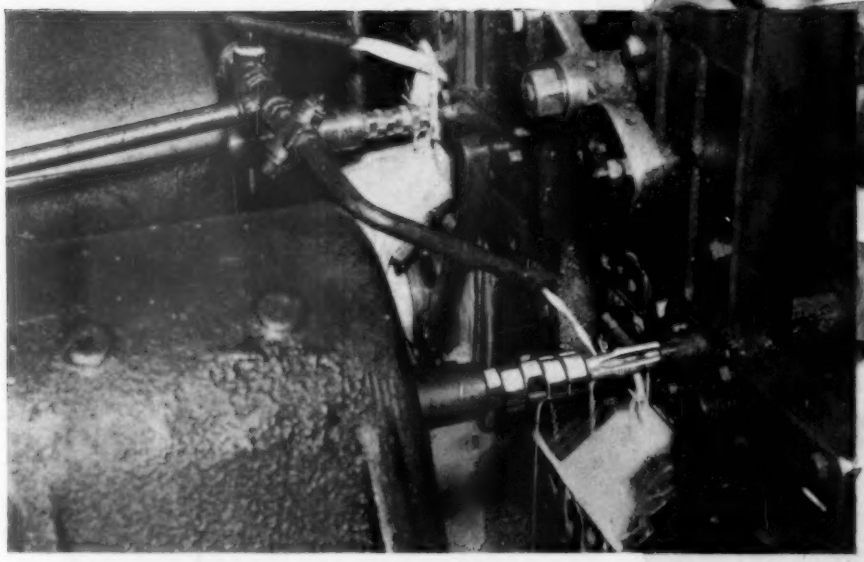

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TAP NUTS
by the Million
with Galtona GROUND THREAD TAPS

The weekly output of a Kosveld continuous tapping machine reaches astronomical figures, and the James Mills production engineers who planned for a prodigious target did not overlook the importance of tool life in their scheme: they were careful to specify the exclusive use of GALTONA GROUND THREAD TAPS on these machines.

The GALTONA range includes all patterns of nut tap with various types of bend as well as those with straight shanks.

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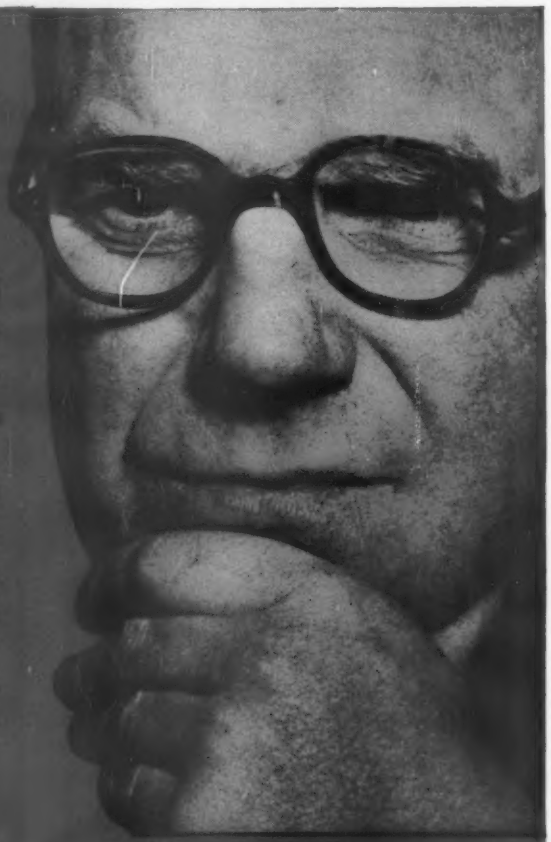
by using drawn
and ground
(KE) SPECIAL STEELS



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set a fresh standard of high efficiency filtration for

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Tecalemit Ribbon Filter Elements

Simple construction—Low cost—High flow rate—Easy to clean

The elements are formed of resin impregnated cellulose ribbon, wound helically and electrically fused into an open-ended cylinder. Innumerable microscopic orifices between the ribbons allow a very high flow rate, while retaining impurities on the outside or inside surfaces, according to direction of flow.

The standard range of diameters (in any length) covers most applications, and no other filtration material can so readily be adapted to individual requirements for filters, strainers, breathers or separators. Never before has such fine filtration been possible at such low cost and with such flexibility in use.

Tecalemit Ribbon Elements filter to maximum purity

Tecalemit Air Breather Filters

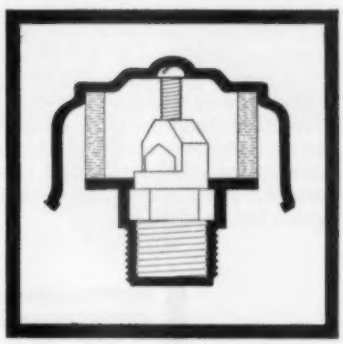
(Incorporating Tecalemit Ribbon Filter Elements)

Cheapest—Most efficient—Cleanest to service

Tecalemit Breathers act as ventilators to provide a free flow of clean air to hydraulic fluid, fuel and oil reservoirs. They give positive protection from airborne contamination to tanks, pumps, valves, cylinder and other engine components.

Of the standard types, two are breathers with screwed bodies, and the third is a combined clip-on assembly of breather and filter cap. All are fitted with Tecalemit Ribbon Filter Elements.

Tecalemit Breathers provide pure air cheaply and efficiently



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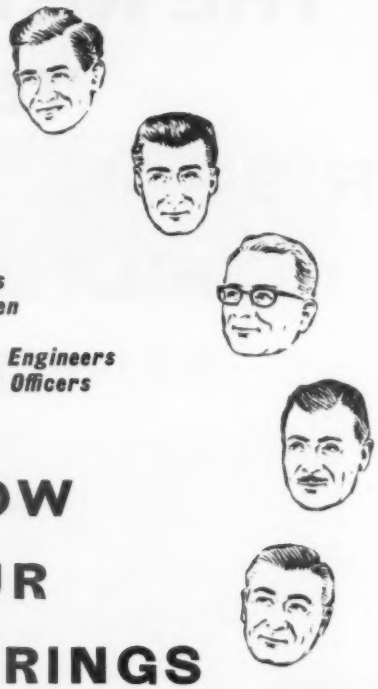

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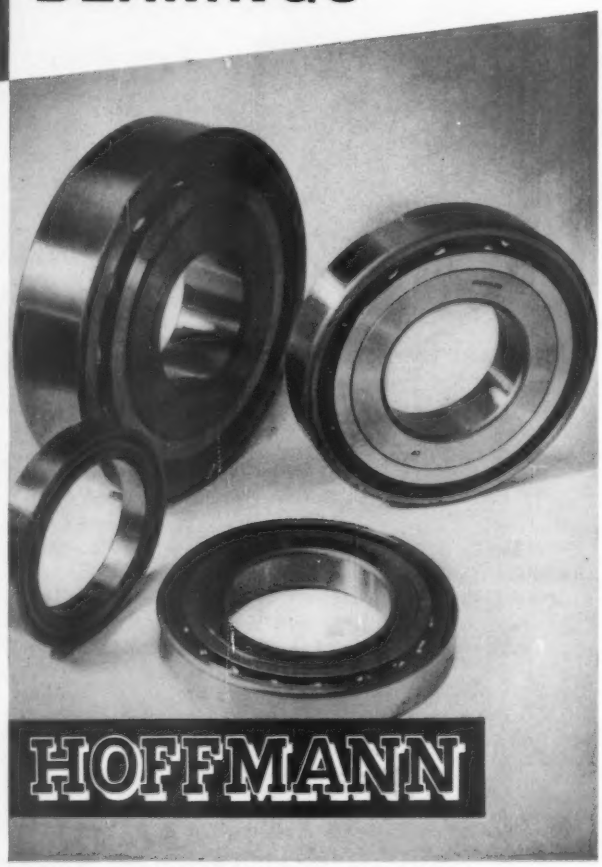
KNOW YOUR BEARINGS

No 2

The Angular Contact Bearing

This bearing, designed about 35 years ago, is similar to the single row ball journal bearing except that the outer race is cut-away around one side. This permits the use of a one-piece cage with more balls than in the ball journal bearing. Bearings of this type are expressly designed for axial loads. The balls are arranged to operate towards the side of the curved track on the inner and outer races, and thus provide the necessary angular contact. This bearing is also suitable for combined radial and axial loads but when used singly the axial load must be in one direction only, and must always exceed the radial load.

When used in pairs, correctly adjusted against one another, angular contact bearings can be used for carrying combined journal and thrust loads in any proportion with the thrust loads in either direction. Such an arrangement is particularly suitable for eliminating end movement in a rotating assembly, and if preloading is employed a high degree of rigidity can be obtained.



HOFFMANN ANGULAR CONTACT BEARINGS

are made in the following series:—

IN INCH SIZES — LIGHT AND MEDIUM
IN METRIC SIZES — LIGHT, MEDIUM AND HEAVY

HOFFMANN

Manufacturers of precision ball and roller bearings — established 1898

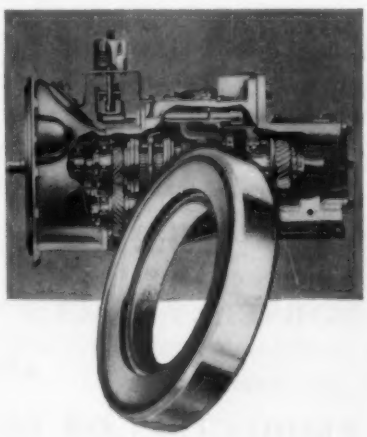
THE HOFFMANN MANUFACTURING CO. LTD. CHELMSFORD, ESSEX

TELEPHONE: 3151 TELEX No. 1951

Mad dogs and Englishmen....

Dust and dirt get everywhere in the midday sun and oil tends to run thin. It's a fine testimony to the sometimes small, but always vital, oil seals on mechanical equipment that they combat these enemies successfully — but then so many of them are SuPerfect.

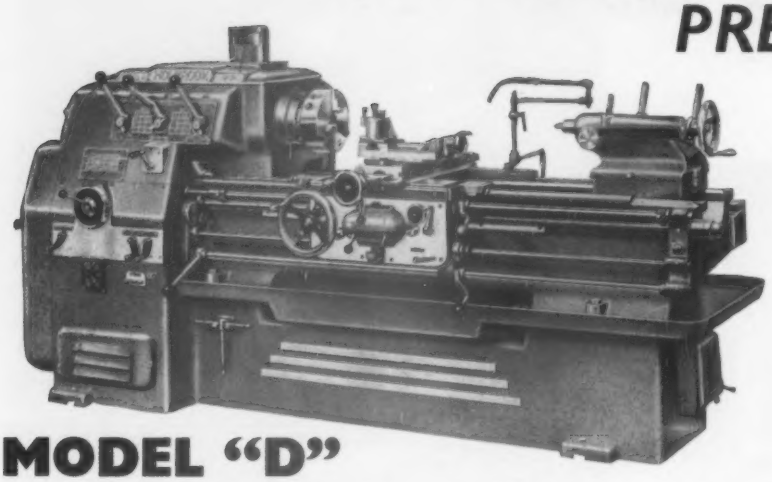
Technical literature describing our complete range of oil seals is available for manufacturers of original equipment. Write for details to :—



SUPER OIL SEALS & GASKETS LTD FACTORY CENTRE BIRMINGHAM 30

TELEPHONE KINGS NORTON 2041

. . . PRODUCTION WITH PRECISION



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UP TO 1000 R.P.M.

CAM-LOCK SPINDLE NOSE

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60 THREADS AND FEEDS

TAPERING EQUIPMENT

PRECISION GROUND BEDWAYS

FULL RANGE OF ADDITIONAL EQUIPMENT

MODEL "D"
PRECISION LATHES

BUILT IN **3** SIZES
SWINGING **13-15-18** INCHES OVER BEDWAYS

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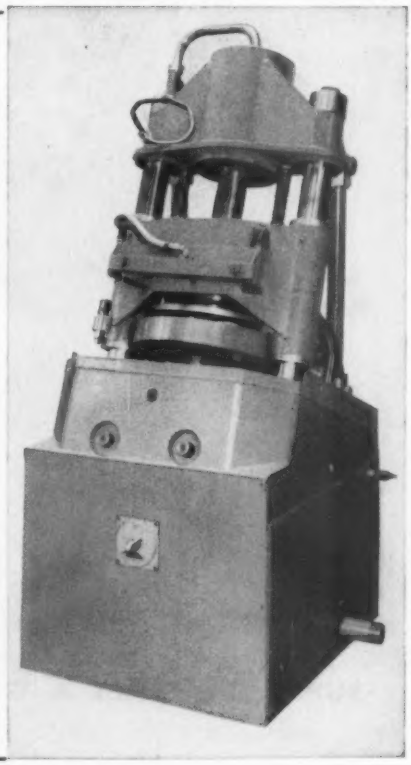

By courtesy of Messrs British Timken Ltd.

ARCHDALE

"Pre-select"

FOR GREATER OPERATING SPEEDS —FASTER PENETRATING CAPACITY

Shown in use at The Electric Construction Co. Ltd., Wolverhampton, this ARCHDALE mechanical 'Pre-select' is fully meeting our claims to cut production times to a minimum. Not only are penetration rates as high as power and rigidity can make them, but much valuable time is saved by convenient pre-selection from 16 spindle speeds, at any time, whether the spindle is running or stationary. Spindle speeds range between 15 and 1,500 r.p.m., and the six rates of feed, selected by a single lever, between 24 and 400 r.p.i.

N.B.—The illustration shows the drilling and spot facing of main fixing holes in end brackets for 250 b.h.p. electric motors.

JAMES ARCHDALE & CO. LTD.

BLACKPOLE WORKS, WORCESTER. **Tel. Worcester 27081 (6 lines)**

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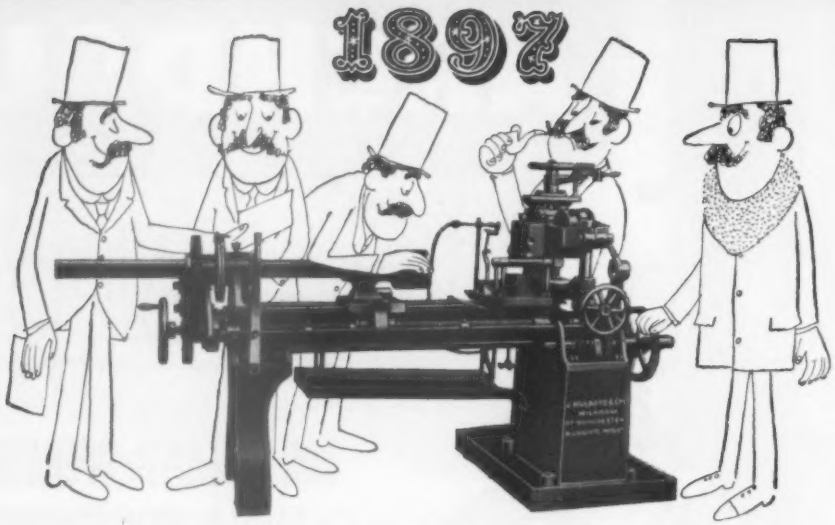

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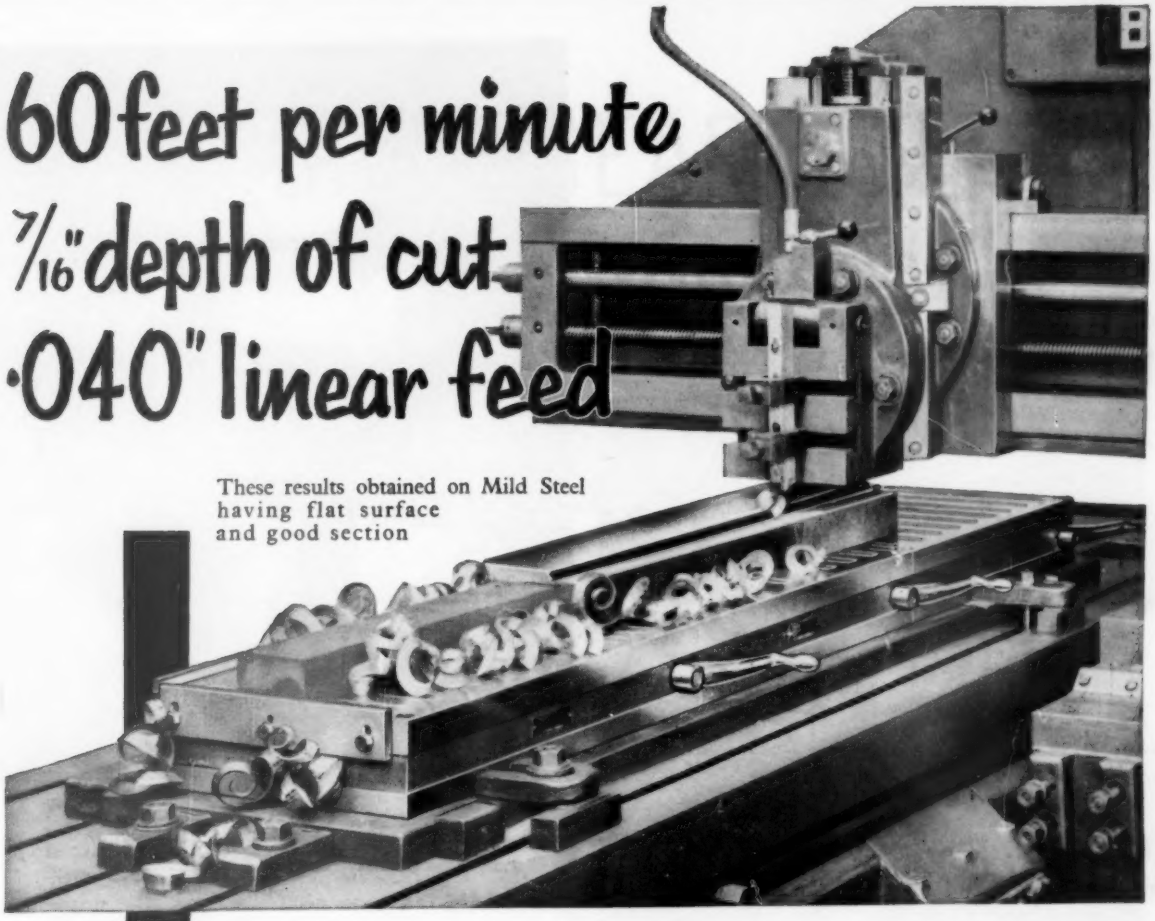

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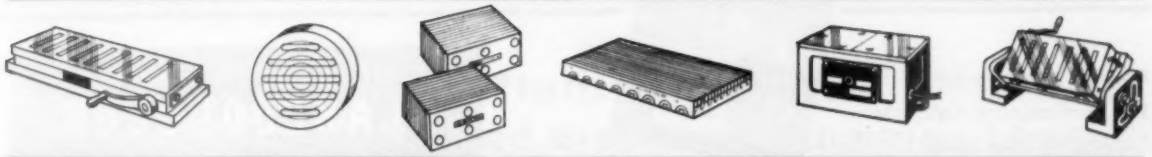

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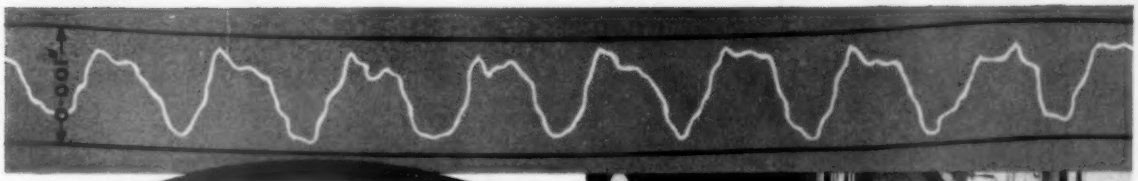

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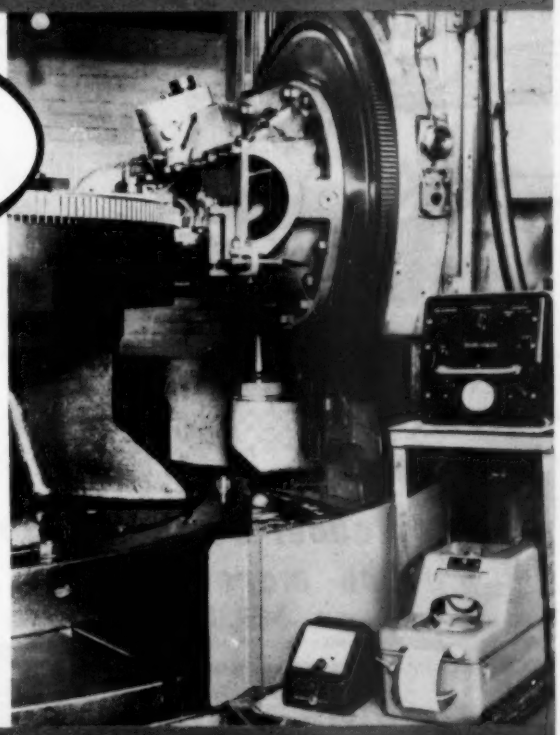

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Mechanical World

AND ENGINEERING RECORD

Vol. 140 NOVEMBER, 1960 Number 3496

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Mechanical World —— November 1960

Escape from Terrain

THE floods of this year and the drought of last display a juxtaposition of those extremes within which lies the average upon which water supply is calculated. The extremes are not usually so close together. It is more usual to have sequences of rather less wet and dry seasons, and to have years with near average rainfall but with different distributions of dry and wet periods. This applies particularly to temperate climes and contrasts strongly with the conditions in other regions. The deserts have seasons but for purposes of water supply their climate is relatively unchanging. The continents have their own characteristic range of weather with markedly dry and wet periods, but they experience aberrations like false summers, and sequences of dry seasons when rivers dry up and vegetation almost disappears. Certain tropical areas are perhaps best served—by the very excess of their rainfall their water supply is at least certain.

The one basic fact of water supply is that the primary source—the water on the surface of the earth and in the atmosphere—is constant and ample. It is the natural distribution by evaporation and precipitation, by air currents and temperature, that is uncertain. The most general course with water conservation is for each community to look after itself, and in the more advanced countries the siting of industry has often been controlled by the availability of sufficient water for processes or cooling purposes. Some recent water schemes are very different from this. While primarily for power generation they also provide extensively for irrigation. Such schemes have a national character and provide a more certain continuity of supply. This trend will be encouraged by new economic factors: distance is now less of an obstacle and if it is politic and profitable to build national motorways there is equal reason for averaging the natural rainfall and storage over greater areas by main grid systems, and thus releasing industry from geographical restrictions. The advances made recently in evaporating techniques offer another source largely independent of siting, and it is being found economically possible to find power for this purpose in widely different climates.

There are many reasons for lessening the over-congestion of population and industry. In a nuclear age such congestion is inadvisable and modern communications make it unnecessary. Its removal requires services of a uniform standard, and the basic one is water supply. Man has released himself from one bond after another: the bondage to terrain remains to be cut, and the means is at hand.

LOG SHEET

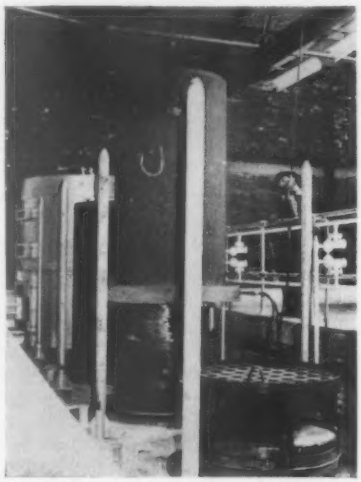
Vacuum Annealing

A bell furnace installation for the vacuum annealing of copper wire, the first British made installation of its kind, has recently been put into operation in the Hazelhurst Works, Ramsbottom, Manchester, of F. D. Sims Limited. The plant was designed and supplied by the Electric Resistance Furnace Company Limited. It uses an Efco bell furnace, transported by an electric travelling crane to serve six bases where the copper wire, in coils or wound on reels, is heated in vacuum-tight containers. The bases accommodate a stack of wire up to 3 ft diameter by 4 ft high, the actual weight of a charge depending upon the size of coils or reels being processed, the maximum weight being about 3500 lb. The wire is normally heated for four hours and then left to cool for from 12 to 20 hours before being exposed to atmosphere. The installation is designed to anneal 34 ton of wire in a working week of 120 hours.

The furnace bell is rated at 85 kW and can operate at temperatures up to 550°C. It has a cylindrical casing of mild steel plate containing adequate heat insulation with a refractory lining, being designed to minimize the stressing of the refractory by the repeated raising and setting down of the furnace. The bell is heated by coils of nickel-chromium wire supported around the circumference of the chamber on sillimanite tubes and arranged in three zones, the temperatures of the zones being independently controlled with automatic indicating instruments. The furnace is accurately positioned over a base by guide posts and the electrical connexions are made automatically.

The six bases which are arranged in a shallow pit to allow sufficient headroom, all have a vacuum-tight steel casing, filled with heat insulation, and carrying on the top a steel charge stand, designed to position the charge well into the hot zone of the furnace chamber. The vacuum containers are of plain cylindrical shape with welded, dished tops carrying a single lifting lug. At the bottom of the containers there is a heavy sealing ring having a machined surface which engages with a water-cooled rubber seating surrounding the hearths.

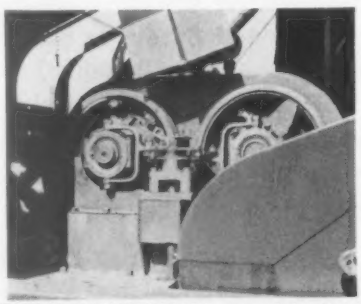
The operating vacua are obtained



Efco bell furnace vacuum annealing installation installed at F. D. Sims Limited, Ramsbottom, Manchester. Lowering a self-sealing hood over a charge of copper wire

with Speedivac pumping gear supplied by Edwards High Vacuum Limited. For the initial purging of a container an air-ballasted roughing pump with an air displacement of 15 cu ft per min is used. The process pump has a displacement of 30 cu ft per min. Either pump can be connected through vacuum valves to any one of the bases.

The installation is managed by a single operator who stacks the charges on the carriers, places the carriers on the bases below the self-sealing vacuum containers, operates the vacuum pumping equipment and moves the furnace. Throughout the heating period the charges and the furnace bell are protected from overheating by a safety device which gives an aural alarm and removes the supply of the furnace elements.



BONDED BRAKE LININGS.—One of the 10-RB excavators in the fleet operated by James Richmond Limited of Retford, Notts., showing the internal expanding brakes which have liners bonded by Holmes & Younie Limited with Redux 64 manufactured by CIBA (A.R.L.) Limited. The use of bonding instead of riveting as a method of attaching the liners gives an increase of up to 50% in the service life of the brakes

Refinery Administration

The recent opening of the new administration building at Shell's Ardrossan refinery, Ayrshire, marks the completion of the major portion of a scheme of modernization and extension. The plant is the major producer of bitumen for Scottish roadmaking and is also a large storage point from which oil products are supplied to many parts of the country.

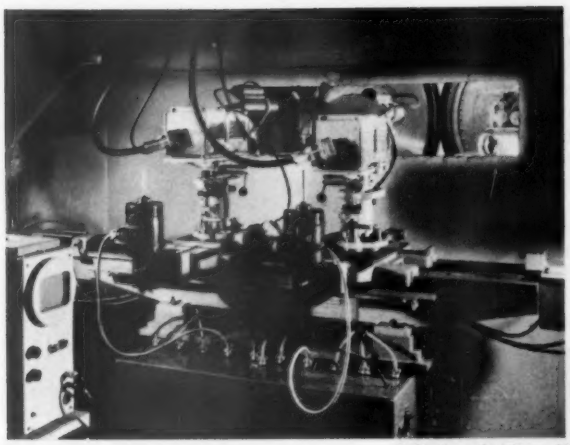
Some 270 people, mostly men, are employed at the refinery where the storage tanks have a capacity of 150,000 ton of oil products. There are over 10 miles of pipeline within the refinery and for cooling purposes the plant uses over 10,000 ton a month of fresh water drawn from the town supply and some 90,000 ton of sea water a month. After use the water is thoroughly cleaned of any oil in interceptors and returned to the sea.

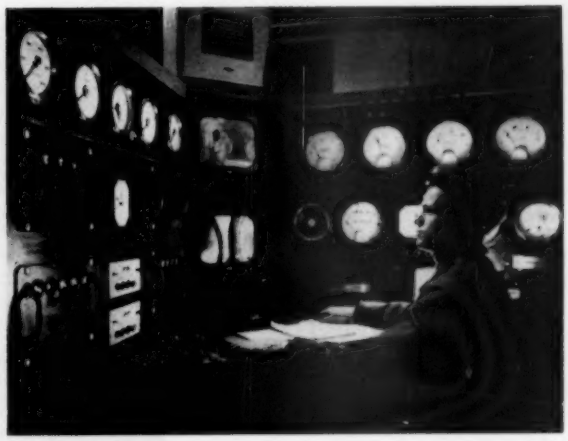
Ardrossan harbour benefits by the tanker traffic. Ships of up to 18,000 ton deadweight can discharge their cargoes, which may be of crude oil or refined products from other Shell refineries. Small coastal tankers sail regularly from the harbour to the Western Isles and elsewhere. Oil products are sent out mainly by road and rail to customers such as the international airlines at Prestwick, the new steel strip mill of Colville's at Ravenscraig, or the normal garage in any town. The road tank wagon fleet at Ardrossan covers over 1 million miles a year.

Tyre Testing

The original Dunlop high speed test plant has been successively modified until capable of testing tyres at 420 mph but is unsuitable for testing at higher speeds. But new tyres intended for speeds up to 475 mph have been developed for the world land speed record attempts and, in order to test these, Dunlops have constructed and brought into operation a completely new test plant. Costing £75,000, the plant is capable of testing tyres at speeds of 500 mph and more.

The testing machine is contained in an underground chamber and operated by remote control from an adjacent building. This machine consists of a vertical drum against which the tyre/wheel assembly is pressed horizontally by a hydraulic ram. Tests can be made up to 550 mph and when testing for resistance to centrifugal forces only speeds up to 675 mph can be employed. The





Left, the television cubicle alongside the machine chamber. The driving drum and the World's Land Speed Record tyre can be seen through the slot for the cameras

Right, an operator at the control desk makes a final check on circumferential speed, using the electronic controls on the left-hand panel, before bringing the tyre into contact with the driving drum. The position of the tyre can be seen on one of the television screens at the centre

load on the tyre can be 1¼ ton and the machine will take tyres up to 12 in. wide and 54 in. dia.

The drum drive is by a 450 hp electric motor, the direction of the rotation being upwards at the tyre contact area, thus helping to relieve weight and reduce friction to the moving parts. The drum also includes special arrangements for measuring power loads.

The tyre/wheel assembly has its own 250 hp electric motor and is also fitted with instruments for measuring power losses. The drive shaft has a Dynamatic brake to impose controlled braking conditions on the tyre. The whole tyre drive unit is connected to the tyre/wheel assembly through a universal joint and at high speeds both are kept in line by automatic electric control.

Both drum and tyre can be brought to rest by a combination of dynamic and disc braking or by disc braking alone, the drum from a speed of 500 mph in 50 sec. and the tyre in 30 sec.

To achieve the absolute minimum of friction in the loading system a three-ton loading carriage floats over its base-plate on an air cushion a few thousandths of an inch thick; the same principle is used in the Hovercraft.

All testing controls are directed from a control desk in the above ground control room. A closed circuit television system operates from two Pye movable television cameras, mounted on separate pedestals travelling along an optical bench just outside the control room. Pictures from these appear on 14 in. screens in the centre of the control room while sound comes through a loudspeaker overhead. The effect is as though the operators were actually sitting alongside the test machine throughout the run.

Taking direct readings on a load guage in the machine chamber, during calibration of the remote loading equipment

Breakdown Cranes

Of the 22 railway travelling breakdown cranes now being built for the British Transport Commission as part of the railway modernization programme. Twelve are of a new 75-ton type, with a greater lifting capacity than any other type of railway breakdown crane in Britain for use on main lines. The remainder, capable of lifting up to 30 ton have been designed to work on both main and branch lines. Two cranes of each capacity are driven by diesel engines with hydraulic transmissions, the first diesel-powered breakdown cranes to be built for use in this country. The rest have conventional steam engines. The first of the new cranes which are being built by Cowans, Sheldon & Co. Limited of Carlisle, is expected to be delivered at the end of 1960.

All the cranes are of the self-travelling type, able to move at slow speeds under their own power, and are capable of lifting, slewing, and derricking operations. They have separate haulage winches for dragging aside debris, and the 75-ton type has an auxiliary hoist unit for lifts of up to 10 ton. The cranes are supplied with outriggers and jacks for use when lifting heavy loads or when working at extended radii. Match wagons are provided to support the jib when travelling in train formation between locations, and roller bearing axleboxes enable speeds of up to 60 mph to be maintained. Separate diesel driven generators are fitted which supply electric power for floodlights and power tools.

The 30-ton type is mounted on a five-axle undercarriage; three of the axles are mounted on the main undercarriage frame and two are mounted in a bogie pivoted at one end of the frame. When the crane is moved under its own power, two centre axles are driven through a train of gears; these can be disengaged when the crane is to be hauled by a locomotive.

The 75-ton type has a four axle undercarriage with two axles driven by a train of gears as in the 30-ton cranes; detachable four-wheeled load-relieving bogies are used at each end when travelling in train formation to reduce the axle loads.

Conveyor for Simca

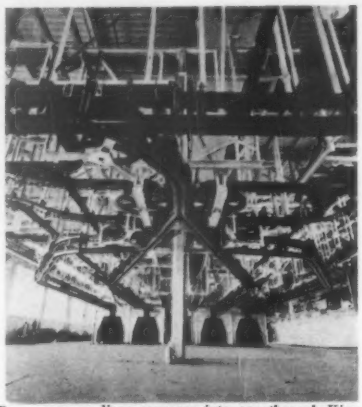
The new paint shop of the Simca motor manufacturing plant at Poissy, France, demanded a particularly involved scheme of mechanical handling, with the added complication of two production lines operating, for the greater part of the process, in parallel yet at widely differing speeds. Where the plant demanded that the two lines should knit together for a single process the timing control for the subsequent return of the body to its appropriate conveyor line was critical.

The design and installation of the complete system was placed in the hands of Geo. W. King Limited, whose design was for an automatic system which would call up bodies from the body shop a floor below, pass them through the various stages of process and inspection, deliver them to the trim line and at the same time supply a flow of advance information to the forward lines preparing to call up bodies through each successive stage.

"Dual Duty" overhead conveyor system was employed in which the loaded trolleys, carrying items being transported, are never fixed to the moving chain, but are propelled by pusher dogs fitted to the links. This makes possible transfer from one line to another, storage in live-line or dead-line, etc. It also makes possible the incorporation of drop sections in the system for the transfer of bodies from floor to overhead conveyor. A load trolley moves into the drop section conveyor rail, where it is locked. The section is then raised or lowered and the trolley moved forward when coupled with the next conveyor.

The completely automatic operation of the conveyors together with the associated indexers, wheel corners, drop sections, automatic transfer units, etc., is under the control of equipment designed and manufactured by the Donovan Electrical Company Limited, Birmingham; speed control being by means of Heenan & Froude variable speed couplings.

The control scheme, which, by the nature of the plant is somewhat complex, has been designed to ensure operation without errors under all normal conditions. Considerable attention has been given to providing for maximum flexibility of operation to enable the plant to be run with certain conveyors out of use to satisfy changing production requirements and to accommodate for possible fault conditions.



Four conveyor lines converge into one through King wheel transfer units

Diesel Loco Maintenance

A major landmark in the elimination of steam traction on the Great Eastern and London, Tilbury and Southend lines was the recent completion of a new diesel locomotive maintenance depot at Stratford, the first in the Eastern Region with centralized workshops, stores, offices and staff amenities. The depot, which has provision for 16 main line diesel locomotives, consists of a double-ended, 300-ft long shed with eight tracks: four on either side of a two-storey workshop, office and staff block—which is placed across the centre. The shed has a precast reinforced concrete frame with an 80-ft span and the roof is covered in double skin asbestos cement sheeting, with fibre glass insulation. Inside, the tracks are carried on 5 in. dia tubular steel supports at 5 ft centres, in order to give freedom of access from the lower floor to the pit. Working platforms, on precast concrete trestles, are 4 ft 6 in. above rail level; the lower floor being 2 ft 6 in. below rail level. The office and workshop block is framed with reinforced concrete; *in situ* on the ground and lower ground floors and precast on the first storey.

The centralized workshop is provided with a 1-ton transporter hand-operated crane, filter cleaning, injector testing, and lubricating oil testing equipment, steel benches, rough cleaning tanks, degreasing plant, paraffin washing tanks, a small pedestal drill and a tool grinder. There are also 15 amp earth proved socket outlets for power tools, 50 volt socket outlets for hand lamps and compressed air points. In addition, portable equipment has been provided to facilitate diesel locomotive maintenance in the sheds. The centre portion of the shed also contains the stores, locker rooms, messrooms, lavatories and wash rooms.

Below left, the first diesel locomotives enter the shed for maintenance

Right, fitters working on a diesel locomotive showing two level working stages

Left, the moulding section at the Penygroes foundry of Austin Hopkinson & Company Limited, mining engineers of Audenshaw

Right, molten metal from the Birlefco mains frequency furnaces being poured into a special mould to form the plug of metal required for starting up the furnace from cold on the following day's operation

Modern Foundries

The new foundry of Austin Hopkinson & Company Limited of Audenshaw, manufacturers of Pikrose mining equipment, at Penygroes, Caernarvonshire has helped to relieve unemployment in the area. Completed in 1959 the foundry is provided with three working bays; one for mould making and cores, one for mould assembly and casting, and the third is a machine shop. A part of the works is equipped as a fabrication section where welded fabrications and steelwork for the main works are constructed. Overhead travelling cranes of 3 ton capacity, with maximum height of lift 15 ft 3 in. to the crane rail, are provided in each of the three bays for handling heavy parts, castings, and ladles of molten metal.

Two Birlefco mains frequency coreless induction melting furnaces are used for melting iron and steel scrap for the production of castings for mining equipment components. High quality grey iron castings up to 1 ton and steel castings up to 10 cwt are produced in the foundry, and can be supplied either as rough castings or finished machined. Each rated at 450 kW, the furnaces have nominal capacitites of 30 cwt. They work alternately, and one furnace can be re-lined whilst the other is in operation. Not only does this arrangement permit day and night foundry operation, but it necessitates only one set of electrical gear. Moulds are stored, cored and closed in the casting bay, where they remain until they are cast.

After close consideration, the foundry was planned and equipped for the production of castings solely by the CO_2 process. Sand of suitable grain size and low clay content is mixed with a sodium silicate solution of appropriate silica/soda ratio and viscosity, and the mixture is then rammed into core boxes or around patterns in the traditional way. The moulds or cores are then hardened by gassing with carbon dioxide. Hardening is extremely rapid, and casting may follow immediately afterwards, since no storing is necessary. A contract has been signed with the Billingham Division of Imperial Chemical Industries Limited for the supply of Drikold solid carbon dioxide, and four Drikold liquefiers have also been installed to convert it into gas.

Standardization was borne in mind when designing the moulding boxes and deciding pattern plate sizes. It was finally agreed to use only three sizes of moulding box, viz. 50 in. × 44 in., 44 in. × 34 in. and 36 in. × 30 in. All patterns are made on single sided boards to suit these boxes.

It was also decided to adopt the NOMAD pallet conveyor system, which is manufactured by Hepburn Conveyor Company Limited, of Wakefield, for handling the patterns and moulding boxes, whose supply also covered the following equipment: a sand slinger for ramming the moulds after the patterns had been faced with CO_2 sand; a rollover strip machine for stripping the patterns from the moulds and inverting the moulds; and a complete sand handling and conditioning plant, including a knock-out machine, screen, storage hoppers, mixers and belt conveyors. The complete sand handling plant was designed to suit the local layout, having an output of 15 ton per hr of backing sand to give a production rate of 80 complete moulding boxes per day. The knock-out and sand handling and treatment section incorporates a modern "Pangborn Ventrijet" wet dust collector.

Pottery Mechanization

Three new oil-fired kilns, which reduce fuel consumption by as much as two-thirds, have been put into operation at the Erith works of Doulton Vitrified Pipes Limited, one of the industrial divisions of the Royal Doulton potteries.

These continuous chamber kilns each consist of 16 chambers, eight on each side of a central dividing wall. Heavy fuel oil is injected by impulse equipment from the top of the kiln into a combustion chamber which protects the product from direct flame contact. The fire travels progressively from chamber to chamber on a predetermined schedule and a very high level of fuel efficiency is achieved. Fuel consumption in this type of kiln has been reduced by two-thirds compared with the old bee-hive kiln, by the preheating of combustion air, the scrubbing of heat from waste gases and by increased thermal insulation.

Other recent forms of mechanization at the Royal Doulton pipe factory include new compressed-air operated extrusion presses which form not only the cylindrical pipes but also some of the complicated bends which hitherto relied on hand moulding, and a mechanical handling system, devised largely by Doulton engineers, enabling the extruded pipes to be delivered to a trimming and finishing machine which then places the article, ready for firing, on a palette for removal by fork truck.

Devices for Feeding Small Cut Sheets

A review of mechanisms used in labelling machinery

By J. A. CUCKSON

NEARLY every commodity or article that is made must carry some form of identification. In many cases this is achieved by placing a label, ticket, etc., on the article or container by hand. The label may have to be coated with glue or it may have been preglued, in which case it must be passed over a moistener. If the label has a thermoplastic material at its back it is passed over heaters to activate the coating. Pressure sensitive labels just need separating and applying.

While there are excellent hand worked gluing machines on the market that are capable of issuing a glued label ready for use, the trend to-day is for mechanization.

Engineers engaged in the designing of automatic machinery, moulding equipment, etc., are now being called upon to provide for the packaging or identification of the particular article after its manufacture. They may have little experience in feeding small cut pieces of paper, for, unlike the materials they are familiar with, draughts, atmospheric conditions, varying qualities of the papers or the glues can cause problems that arise at varying intervals throughout the day.

Feeding sheets for gluing

The first consideration is the question of whether to feed the cut sheets (1) by taking the uppermost sheet from the pile or (2) by removing the sheet from the bottom of the stack. The latter has the advantage that the magazine can be replenished whilst the device is working. With this method there are no additional mechanisms required to keep the pile at a constant level as when taking the uppermost sheet. A sheet feed which employs the top sheet removal method can be refilled during the time the device is operating, but takes a little longer than when loading from the top. In either case the major problem is the separation of a single sheet from out of the label magazine. A proved design with one class of paper does not ensure an equally efficient device when working with other types of papers.

Methods of separation

There are many methods in use and they may be grouped under the following headings: glue pads, glue pickers, pneumatic platens, suction pipes, friction wheels, gripping fingers, slides or may be a combination of any of these.

Glue pad separation

One of the most successful methods of taking a label from a magazine is that used in can labelling equipment. Fig. 1. Narrow lines of glue are applied to the sides of the cans as they pass through the machine and these adhesive areas come into contact with the uppermost wrapper which promptly adheres to the side of the can. As the can continues its rotary travelling motion, the wrapper is wound around the whole circumference of the can. The can passes what is known as a curl rod A, which is positioned adjacent to an endless adhesive belt B. This belt is used to make certain that the whole width at the end of the wrapper is glued. Owing to the pulling action of the can on the wrapper past the curl rod, it induces a slight curl in the wrapper and the adhesive causes this end of the wrapper to adhere over the opposite end of the wrapper. Outputs of 600 to 750 cans per minute have been achieved over a great number of years.

Glue pads

In this device (Fig. 2), below the plane of various cross slides A there is a glue pot B into which there is a fixed revolving glue wheel C. Carried by suitable mechanism there is a second glue roll D which is made to travel in a vertical plane. By so doing, this roller picks up adhesive from the glue wheel in the pot and transfers it to the face of the rubber pad carried by the slide A. As the article comes to rest at station II, the slide B takes the label magazine F into contact with the glued stencil

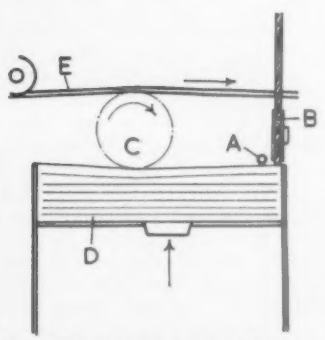


Fig. 1.—Glue pad separation as applied to can labelling. A, curl-rod; B, adhesive belt; C, can; D, label magazine; E, can feed belt

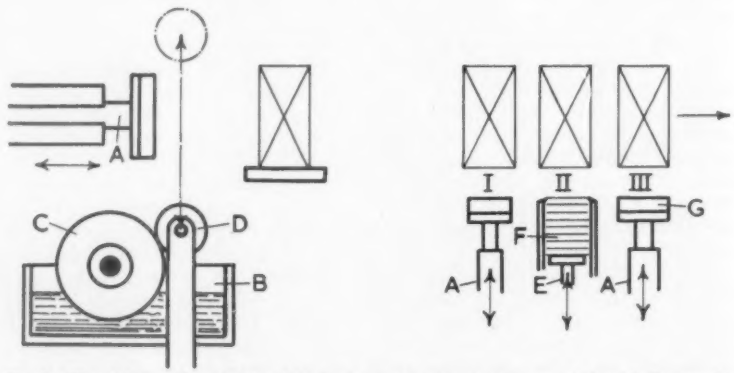


Fig. 2.—Glue pad separation. A, cross slide; B, glue pot; C, glue wheel; D, second glue roll; E, magazine slide; F, label magazine; G, rubber pressure pad

area on the article. The unprinted surface of the first label adheres to it and as the magazine moves away, the label is removed. At station III a pressure pad G applies pressure to the label and causes it to adhere firmly to the article.

Glued pickers (Figs. 3 and 4)

Glue is applied to a pair of metal picker blades A by means of a travelling glue roll B which is used to transfer the glue from a glue roller fixed in a gun bath. Having been coated with glue the blades are then moved into contact against the lowermost label in the magazines C and removes it as the pickers move away. The pickers then lay the glued label on the article after which it comes under the influence of a pair of rubber fingers D, Fig. 4, which serve to smooth the wrapper around the article to give a better adhesion.

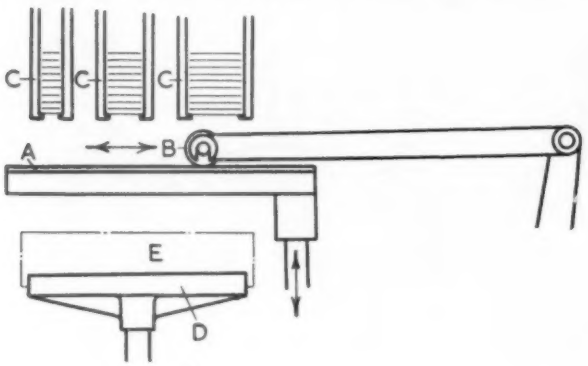


Fig. 3a.—Glued finger device. A, glued label pickers; B, label magazine; C, label applying arm; D, glue pot

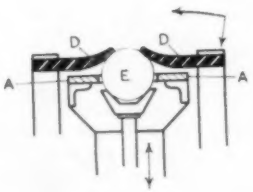


Fig. 4.—Label wiper fingers. D, rubber wiper fingers

A modification to this is shown in Fig. 3A, in which the label pickers are carried by an oscillating arm A. The label picker blades being coated with glue are moved into contact with the label magazine B and remove the label as the arm swings away. The arm carries the label towards the article until a second oscillating arm C moves between the two picker blades and so transfers the label to the article. The article is then carried to a further pressure station.

Rotary glue pad system

In this device, Fig. 5, an even coating of adhesive is applied to the projections of the rotary glue pad cylinder A and as they contact the label magazines B, which are oscillated in timed relationship with these pads, the lowermost label is drawn from the pile. A second cylinder C with correspondingly spaced pads is equipped with small grippers D which strip the glue label from the coating cylinder and then apply it to the article in one continuous movement. Further pressure is applied elsewhere to ensure firm, smooth adhesion.

Fig. 6 shows a modified form of label separation and application. In this arrangement the label is separated from the bottom of the pile by means of a rocking suction head A which is given its lengthwise movement by means of the oscillating arm B. When the head is at the left side of the magazine the suction port is uppermost and as it starts to move in an anti-clockwise direction it pulls the edge of the label into the jaws of the gripper C carried by the rotary drum D. The label is withdrawn and held on the projection of the drum until it comes into contact with the glue roll D which coats the back of the label with adhesive. Further movement of the drum places the glue label on the article as it passes beneath it. Additional apparatus is required to smooth out the label to give satisfactory adhesion.

Fig. 3.—Glued pickers. A, picker blades; B, glue roll applicator; C, label magazines; D, article support; E, article to label

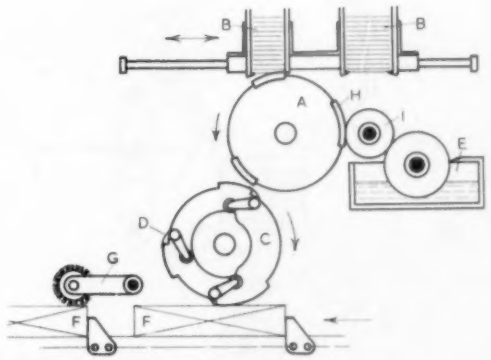


Fig. 5.—Rotary glue pad system. A, rotary glue pad cylinder; B, label magazines; G, transfer cylinder; D, grippers; E, glue pot; F, article; G, label smoother; H, gluing pads; I, gluing roll

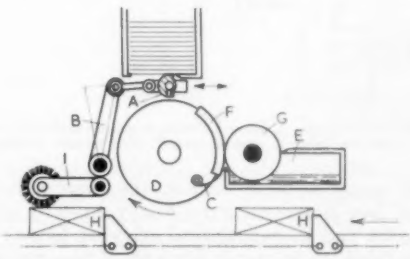


Fig. 6.—Oscillating suction head. A, oscillating suction head; B, reciprocating arm; C, gripper; D, rotary glue pad drum; E, glue pot; F, gluing pad; G, gluing wheel; H, article; I, label smoother

A further alternative is shown in Fig. 7. The rotary wheel A is equipped with suction holes whose operation

is controlled by means of the vane B. As the wheel rotates beneath the label magazine, the label is withdrawn and held in contact with the projections to be carried past the glue rolls and then placed on the article, as in the method outlined in Fig. 6. In this case the air being expelled helps to place the wrapper on the article.

In Fig. 8 the adhesive is applied to the working surfaces of a polygonal drum A by means of a roller B, carried by an arm C. The label magazine D is constantly urged upwards and periodically the top label is pressed against the drum by suitable mechanism. The magazine is withdrawn to allow the corners of the drum to pass

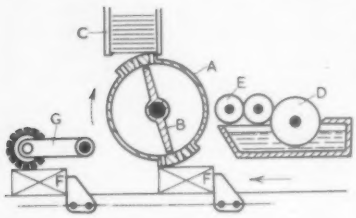


Fig. 7. (left)—Suction wheel. A, rotary suction and gluing wheel; B, suction control wheel; C, label magazine; D, gluing device; E, glue applicator; F, article; G, label smoother

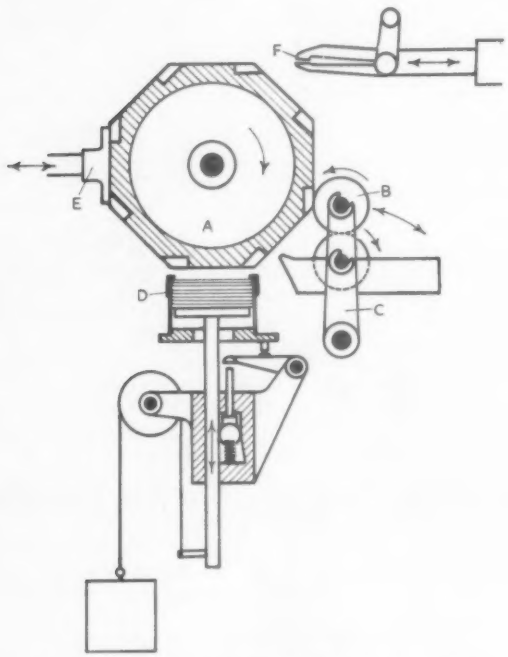


Fig. 8.—Glued drum system. A, polygonal drum; B, glue applicator; C, carrier arm; D, label magazine; E, pressure pad; F, label transfer grippers

clear. At some suitable station, the label adhering to the glued face is pressed more firmly on it by means of the pressure pad E. Mechanical gripping fingers F then seize the label, withdraw it from the drum and place it in position over the article to be labelled.

Suction pick up and transfer

Where precise labelling is required it is usual to use the type of apparatus shown in Fig. 9. The label is removed from the top of the label magazine A by means of a pneumatic platen B. The platen is made a little less in area than the label being worked. After taking out the label it continues being held on the surface of the platen and is passed over the gluing rolls C on to the product, all in a straight line motion. Pressure pad D finalizes the labelling operation. In a modification, the platen is lowered on the pile, lifts up, makes contact with the glue roll and at the end of its stroke drops down again to apply the label to the article.

Fig. 10 shows another type of suction label pick up and transfer device used for placing the cut sheets into the path of conveyor fingers or ready to be seized by mechanical or pneumatic transfer fingers.

A variation of this type of feed is shown in Fig. 11. The suction tube A takes down the edge of the wrapper

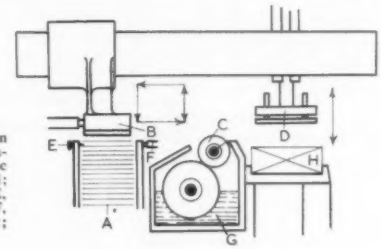


Fig. 9. (right)—Suction platen. A, label magazine; B, pneumatic platen; C, gluing roll; D, pressure pad; E, separating needles; F, air nozzle; G, glue pot; H, article

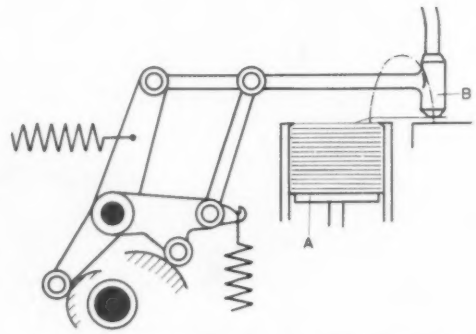


Fig. 10.—Mechanical suction device. A, label magazine; B, suction nozzle; C, mechanism to give path shown in dot-dash to suction nozzle

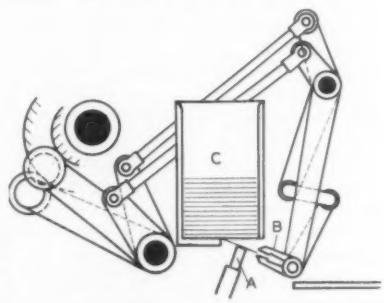


Fig. 11. (right)—Suction nozzle with grippers. A, suction nozzle; B, mechanical grip fingers; C, label magazine

at an angle and holds it to permit the mechanical fingers B to seize the wrapper after which the vacuum is released and the label taken to its predetermined position. Fig. 12 employs a suction pipe A which takes hold of one corner of the label and turns it through an angle of 30° to 45° after which the slicer blade B passes between the separated sheets and lifts the pile clear of the magazine base to permit mechanical grip fingers to withdraw the sheet from the pile.

Alternatively, after the suction pipe has taken down the corner of the label and the slicer blade has moved in, the whole pile of wrappers is raised leaving the first

sheet beneath the slicer blade. In this case the slicer blade may be constructed with suction holes on its underside and as it withdraws it takes the separated sheet with it.

A series of suction tubes working in conjunction with the rotary glue pad system as shown in Fig. 13 is a most satisfactory device.

Friction feeds

In this type of sheet feed the design is based on the fact that friction between rubber and paper is greater

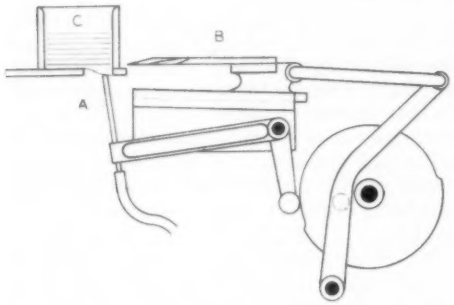


Fig. 12.—Suction tube with slicer blade. A, suction tube; B, slicer blade; C, label magazine

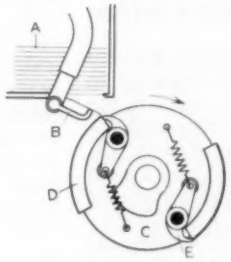
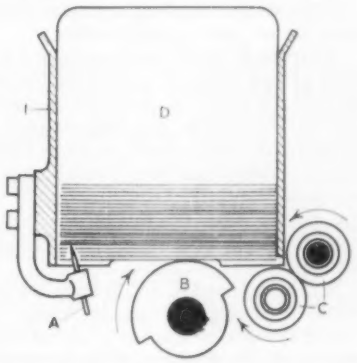


Fig. 13.—Suction nozzle with rotary wheel. A, label magazine; B, oscillating suction nozzle; C, rotary gripper and glue pad wheel; D, glue pad; E, label gripper



than the friction between two sheets of paper. A frequent example of this method is shown in Fig. 14. The needles A are so adjusted that they penetrate five or six sheets. The continuously revolving roller B drags the lowermost sheet from the needles into the path of the high speed pulling rollers C. A similar device can be employed if, the labels are to be fed from the top of the magazine.

Another type of feed is used in which the friction roller is carried on a rotating yoke and rotates at high speed by means of a sun and planet gear system to push the sheet into the high speed forwarding rollers. The use of forwarding rollers is a feature that can be used in all types of web sheeting and feeding purposes.

Fig. 15 shows a suction tube feeding method which draws the sheet into contact with the continuous bottom feed roller A. After this work has been performed the cam driven arm B carrying the top forwarding roll C moves downwards until it touches the periphery of the feed roller A and so draws the sheet from out of the magazine.

High speed devices

These are chiefly made up by employing existing units in tandem or triplicate or by the use of platens carried on turrets. In cases of this sort the glue applying rolls or belts are made to operate in the vertical plane. Such devices are used when labelling bottles at a speed of approximately 200 per minute.

Safety devices

In all cases where a glue applicator is used there must be a safeguard against the platen or pad coming into contact with the glue roller when no label has been picked from the label magazine. The use of a suction pick up can be used as the feeling or sensing mechanism. A drop-in, or loss of vacuum due to absence of the sheet brings in mechanism to prevent the glue roll from making contact with the platen surface. The same results can be achieved mechanically and may be extended to—no product—no label—no glue.

Pressure devices

The final act of all labelling equipment to ensure that the label is firmly adhering to the article. There are three types of mechanisms used: direct pressure, wipers and rolling pressure types.

In the former, there is some form of registration which has sufficient stationary time for the rubber-covered pressure plate to move downwards to do its work and then move clear. This method generally dictates the speed of the labelling machine but if an increase in speed is required the plate can be made to travel in a D-

Fig. 14. (top right)—Friction feed. A, support needles; B, rotary friction roller; C, high speed forwarding rolls; D, label magazine

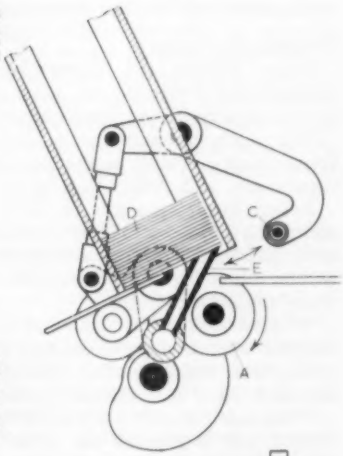
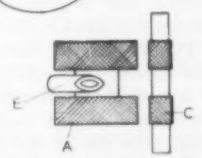


Fig. 15. (right)—Suction nozzle with cam actuated forwarding rolls. A, bottom feed roll; B, cam driven arm carrying forwarding roll; C, forwarding roll; D, label magazine; E, suction nozzle



shaped path. If the articles are cylindrical the maximum coverage for the plate may be in the region of 140°, the actual shape dictates the pressure. Additional mechanisms can be used to increase the area of coverage.

On the wiper or brush type of pressure mechanisms designed to have a reciprocating motion it is essential that they are moved clear at the end of their working stroke or the label may roll back on itself.

A wiper device as shown in Fig. 4 comprises two rubber flexible fingers arranged so that as they are carried into contact with the article the sheet or label is wiped over its surface. This device is used chiefly for cylindrical articles. For rectangular or square articles a bristle brush is often used instead of the

rubber fingers. In those devices where the output of articles is continuous, the brush is mounted as shown in Figs. 5–7 or can pass beneath fixed lengths of brushes. The most common form of rolling pressure design is where the top member is stationary and the article, usually cylindrical, is carried through it by means of a continously driven belt. Depending on the relationship between the width and height of a square or rectangular object it may be possible to adapt the same device for these also.

Articles having flat surfaces are also made to pass between a pair of rollers if greater pressure is required, because of the line contact.

If the article is cylindrical then a third roller is brought into use to give a cradle effect.

Another form of pressure device is to employ delivery belts at the top and bottom. If the article is squarish in section the speed of the belts should be the same as the article. Should the top belt be held stationary and the speed of the bottom belt be made twice that of the article then a similar situation is achieved as when using a fixed top pad. Similarly, if the direction of the article is reversed the device may be shortened, but this is not highly recommended because of the difficulties of getting the article between the belts.

It is also possible, by altering the relative speeds of the belts, to make the article rotate in either direction. The difference in the velocities of the two belts is determined by the number of turns of the article to give a satisfactory seal to the glued lapped joint.

Troubles that arise

When feeding cut sheets from a magazine many troubles and difficulties can arise if attention is not given to the quality of the sheets themselves.

The main reasons for a sheet feeding device not functioning correctly is the porosity of the sheet, sheet separation, and fabrication of the label.

Before inserting a pile of sheets into the magazine it should be divided into smaller stacks and bent by hand in a longitudinal and transverse direction to loosen the locked edges that may have been caused through using blunt guillotine blades.

A similar result is achieved if the paper sheets are slapped over a sharp edge and ruffled before they are placed into the magazine. The sheets must be cut to a specified size, a tolerance of 1 m/m is generally acceptable.

If the size varies in the pile the larger sheets tend to get lodged and to prevent the remainder of the stack from falling flat on the base of the magazine.

Printing on the sheets may tend to emboss the sheet and this causes the sheets to stick together.

Again, if the sheets have been guillotined before the printing ink has been thoroughly dry, this will also cause the sheets to stick.

The direction of the grain in the sheet can be a most important factor in those feeds which employs needles for separation. Sheets which are badly curled can cause troubles which, in many cases can be rectified with temperature and humidity controls.

Although it is a simple matter to design a magazine to handle a wide range of sizes, frequent changeover is not only time wasting but often results in a device of low efficiency taking some time to "settle down" even though the previous wrapper has been running perfectly.

Oxide Refractories

Morgan Refractories Limited, Neston, Wirral, Cheshire, have recently developed a new range of pure oxide refractories, to which they have given the generic name 'Purox'. Some of these refractories, such as impervious thoria, have become a practical possibility for the first time. Others have already been available in a very limited range of shapes and sizes. For the first time recrystallized alumina in a great range of sizes and shapes is made possible by the new techniques developed at Neston, and all these refractories are now available on a commercial scale.

The oxides are: recrystallized alumina, sintered pure alumina, impervious thoria, standard thoria, pure magnesia, and stabilized zirconia.

No bond is added in the manufacture of these refractories. Cohesion is the result of either a sintering action (porous grades) or of entirely new crystal growth in the formed shape. The finished ware is as pure as the refined oxides from which it is made.

With the exception of recrystallized alumina, there is no standard stock range of Purox ware. In most, if not all, cases customers' enquiries and orders are treated individually; thus Purox is a tailor-made commodity.

Purox impervious recrystallized alumina is 99·7% Al_2O_3 and has a maximum service temperature of 1950° C. Crystal structure of the fired refractory is the result of heat work alone, there being no addition to induce or control crystal growth. This material can be supplied as tubes, sheaths, crucibles, bricks, tiles, die pressings and special shapes. The size range is the widest available and tubes up to 177·8 mm bore, 1219·2 mm long, crucibles up to 8000 cc and tiles up to 381 × 127 × 63·5 mm can be supplied to order.

Purox sintered pure alumina is 99·7% Al_2O_3 and has a maximum service temperature of 1450° C. This is the same material as 'Purox' Recrystallized alumina, but fired to a lower temperature and is not impervious. The size range is wider than that of Purox recrystallized alumina.

Purox impervious and standard thoria has a maximum service temperature of 2600° C. The raw material used is 99·9% ThO_2. The finished refractories, whether standard or impervious, have the same analysis. Purox impervious thoria is pure and is the most refractory oxide commercially available and can be made impermeable without the help of an added glassy phase.

Crucibles up to 250 cc and tubes and sheaths in a somewhat restricted range of sizes are in current production. At one end of the scale tubes 8 mm bore, 12 mm O.D. and 500 mm long have been made; at the other, tubes 32 mm bore with a 3 mm wall thickness and 660 mm long.

Purox pure magnesia has a recommended maximum service temperature of 2400° C. The material is available in the form of crucibles, tubes, bricks, tiles and small die pressings. The analysis varies with the method of manufacture but is never less than 98% MgO.

Purox stabilized zirconia is 97% ZrO_2 and has a recommended maximum service temperature of 2300° C. This grade is stabilized against crystal inversion and is available in the form of crucibles, tubes, sheaths, tiles and brick shapes.

Purox ware is often required to very accurate dimensions, and grinding facilities are available to meet such requirements. Plus or minus 0·0254 mm can be achieved, on outside diameters up to 203·2 mm, over lengths up to 914·4 mm long, and in bores up to 152·4 mm, over lengths of 304·8 mm.

Acidity of Aqueous Solutions

The standard method of measuring the acidity or alkalinity of aqueous solutions is by reference to the 'pH' scale. This brief article describes the derivation and significance of 'pH' numbers and some of the limitations in measurement

LOOSELY, aqueous solutions are said to be acid when they are characterized by a bitter taste, an affinity for chemical attack on metals, etc., whilst alkaline solutions are 'soapy' or 'greasy' and, in higher concentrations, possess marked 'caustic' action. The predominance of either acidity or alkalinity in a solution can be determined by simple indicator tests, which is a standard chemical technique. Industrially, however, a very much closer measure of the degree of acidity or alkalinity of an aqueous solution is often required—hence the evolution of the pH scale as a measure of the hydrogen ion concentration.

Acid characteristics are directly related to the hydrogen ion concentration in the solution and the only exact measure of the degree of acidity is to determine the effective concentration of hydrogen ions or the active 'acid' component in the presence of water.

Water itself is neutral, provided it is pure, with very little tendency to ionize. That is to say pure water consists almost entirely of hydrogen and oxygen atoms combined in the molecular state (H_2O) plus a little which has ionized into hydrogen and hydroxyl groups—

$$H_2O \rightleftharpoons (H+)+(OH-)$$

The number of ions so produced is approximately 1/100,000,000,000,000 or 10^{-14} gramme ions per litre at normal temperatures (about 25°C) and is always constant for a particular temperature, although different for different temperatures. Being a neutral solution the amount of positive and negative ions are equal, hence it follows that the concentration of hydrogen ions is 10^{-7}.

Now the addition of acid to the water increases the concentration of hydrogen ions although the same total concentration of ions remains (for a given temperature). Hence the corresponding concentration of hydroxyl ions is reduced. Similarly, the addition of an alkali increases the concentration of hydroxyl ions at the expense of a decrease in the proportion of hydrogen ions. Characteristically, therefore, acid solutions are electro-positive and alkaline solutions electro-negative and the degree of 'positive' or 'negative' concentration relative to a mean point expresses the degree of acidity or alkalinity of the solution.

Since the total concentration is unchanged, a measure of the ion concentration can be given by allocating the arbitrary value of 1 to either the hydroxyl ion concentration or hydrogen ion concentration when the range of measurement becomes up to 10^{-14} with a mean value, 10^{-7}, corresponding to a truly neutral solution.

This, however, is not a suitable practical scale and to overcome its limitations the pH scale was evolved as

$$(H+)=10^{-pH}$$

whence

$$pH=-\log_{10}(H+)$$

The full range corresponding to a range of hydrogen ion concentration of 1 to 10^{-14} now becomes 0 to 14 with the neutral position at pH = 7. pH numbers progressively *smaller* than 7 represent increasing acidity; and pH numbers progressively *greater* than 7, increasing alkalinity. Being a logarithmic scale a change of one unit represents a change of 10 times in the hydrogen ion concentration. The pH scale in this form remains the standard of reference or measurement, although now taken to refer to the hydrogen ion *activity* rather than the hydrogen ion concentration, the difference being a subtle one which can be ignored for most practical purposes.

Accurate measurement of pH is normally accomplished with measuring electrodes, compensated for temperature effects and incorporating a 'buffer' solution to ensure a constant potential on the inside surface. Basically, a buffer solution is one capable of maintaining a constant pH although most salts have a 'buffering' action in that their presence as impurities can neutralize part of the hydrogen ion concentration in solutions. Thus one of the essential requirements of accurate pH measurement is the avoidance of such conditions.

The use of normal chemical indicators, for example, as in colorimetric determination of pH, can lead to large errors since the indicators themselves may be either weakly acid or base and so upset the original balance of concentration. A method of overcoming this limitation is to 'buffer' the test solution so that there are no additive effects. Similar undesirable effects can also arise from interaction between the electrode material and the presence of minute amounts of salts in the solution. Hence the glass electrode is usually preferred although this, too, is subject to limitations in certain circumstances. In strongly alkaline solutions the sodium silicate content of the glass may develop a sodium ion activity, and thus a false low reading, limiting their application to pH values of about 10. Lithium glass electrodes are free from this limitation and give a basically correct reading right up to 14 pH.

Equally important to choice of electrode is position, the sensitivity usually being extremely high. Thus in a system where the ion concentration is modified by the introduction of additives or reagents promoting chemical action, the position of the electrode must be chosen to correspond to a completion of the reaction and a consistent fluid composition, otherwise widely varying and highly misleading results may be obtained. Similarly, the measurement of 'static' solutions may require premixing, or not, depending on the scope of the investigation. Technique in application of the measuring instrument, in other words, is just as an important factor as the design of the instrument itself.

Heat Loss Calculations

A basic approach to heat loss calculations is described in this article. Insulation efficiency as a performance rating is largely arbitrary and can be misleading. The logical design approach is to relate total cost of insulation to insulation thickness

HEAT losses from an insulated plane body are determined by the rate of conduction of heat through the insulation plus losses at the surface of the insulation due to radiation and convection from that surface. The former can be determined accurately with reference to the thermal conductivity of the material although surface losses are most readily assessed on empirical lines.

Conduction is directly related to the temperature gradient and the heat flow (Q) can be expressed as

$$Q = k(T_{s_1} - T_{s_2})/d$$

where T_{s_1} = the higher temperature at surface s1
T_{s_2} = the lower temperature at surface s2
d = the distance between the surfaces
k = the coefficient of thermal conductivity, specific to the material. (Fig. 1.)

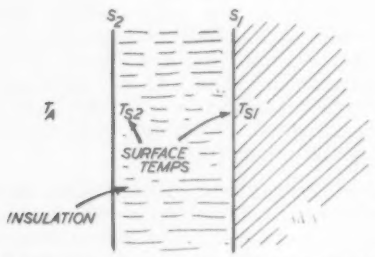


Fig. 1.—Conductance heat flow through insulation is dissipated by surface

Although specific values are allocated for k for various materials, strictly speaking k is not a constant but varies with temperature. As a generalization, for conventional insulating materials k tends to increase with increasing temperature. Thus correctly the value of k appropriate to the mean insulation temperature should be taken (i.e. the mean of T_{s_1} and T_{s_2}). For practical working the basic formula then becomes

$$Q = K_{tm}(T_{s_1} - T_{s_2})/t$$

where k_{tm} = coefficient of thermal conductivity relative to a temperature of $(T_{s_1} + T_{s_2})/2$
t = thickness of insulation (being a more convenient convention than 'distance' traversed).

The theoretical heat loss by radiation is given by the Stefan-Boltzmann law which states that the radiant heat loss is proportional to the fourth power of the absolute temperature difference (between the hot surface and ambient). This is not normally applied in practice as it is tedious to calculate. Instead, empirical formulae

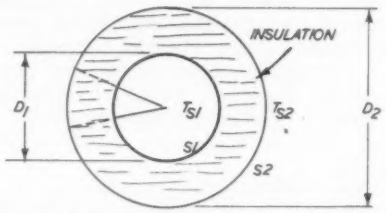


Fig. 2.—Mathematics of pipe and cylinder insulation is complicated by increasing area of insulation with increasing thickness

are used, based on the type and location of the surface concerned. Typical values are summarized in Table I. This combines all surface heat losses, due to both radiation and convection, in a single surface heat loss factor f, when

Q due to surface heat losses $= f(T_{s_2} - T_a)$ where T_a is the ambient temperature.

The total heat loss is then expressed by summing the heat loss by conductance and the surface heat losses, viz.—

$$Q_{total} = [k_{tm}(T_{s_1} - T_{s_2})/t] + f(T_{s_2} - T_a)$$

For convenience of handling—and to express the result in useful terms—the heat flow is best related to the

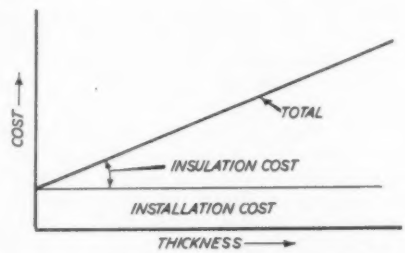


Fig. 3.—Total cost of applying insulation plotted against insulation thickness

Table I.—SURFACE HEAT LOSS FACTOR f

Condition	Non-metallic hard finishes	Bituminous and painted finishes	Non-polished metal	Semi-polished aluminium and aluminium paint
Plane, flat, facing down	1·30 + 0·006 ΔT*	1·30 + 0·006 ΔT*	1·35 + 0·006 ΔT	1·0 + 0·005 ΔT*
,, ,, facing up	1·66 + 0·009 ΔT*	1·62 + 0·009 ΔT*	1·68 + 0·009 ΔT	1·36 + 0·007 ΔT*
,, vertical, up to 3 ft high	1·38 + 0·007 ΔT	1·42 + 0·007 ΔT*	1·46 + 0·007 ΔT	1·12 + 0·006 ΔT*
,, ,, over 3 ft high	1·42 + 0·007 ΔT*	—	—	—
Pipes—vertical	1·42 + 0·007 ΔT*	1·42 + 0·007 ΔT*	1·42 + 0·007 ΔT*	1·12 + 0·006 ΔT*

ΔT = (outer surface temperature — ambient temperature) °F
*Stillite Products Limited.

total temperature difference ($T_{s1}-T_a$) when the equation simplifies to

$$Q_{total} = \frac{T_{s1}-T_a}{k(t/t_m) + (1/f)} \text{ Btu/sq ft/hr}$$

$$\text{or } T_{s1}-T_a = Q(t/k_{tm} + 1/f)$$

k is then normally expressed in terms of Btu/in./sq ft/hr/°F consistent with the thickness of insulation t being measured in inches and temperatures in degrees Fahrenheit.

This formula is appreciably modified in the case of pipes and cylindrical bodies where the cross section of heat flow from the hot surface is effectively increasing with increasing diameter (or insulation thickness). The effective area concerned is now the logarithmic mean area between the pipe surface and the outer surface of the insulation, which for unit length of pipe becomes

$$\pi t/6 \log (D_2/D_1)$$

where D_1 = inner (pipe) diameter
D_2 = outer (overall) diameter (Fig. 2.)

The quantity $\pi/6 \log (D_2/D_1)$ can be designated $1/x$, when effective area $= t/x$

Heat loss by conductance then $= k(t/x)(T_{s1}-T_{s2})/t$
$= k(T_{s1}-T_{s2})/x$

Surface heat loss is directly related to the surface area and expressed simply as

Q due to surface heat losses $= (\pi/12)D_2.f.(T_{s2}-T_a)$ per foot length consistent with diameter being measured in inches.

Fig. 4.—Insulation performance plotted in the form of cost of heat loss against thickness

For convenience again the quantity $\pi D_2/12$ can be expressed as $1/y$ when the corresponding formula for total heat loss from pipes and cylinders becomes

$$Q_{total} = \frac{T_{s1}-T_a}{x/k + Y/f} \text{ or } (T_{s1}-T_a) = Q(x/k + y/f)$$

This is the fundamental form of the equation used for calculating heat losses from insulated cylindrical surfaces. Again, of course, the mean value of k should be used for practical calculation.

These equations are used, as appropriate, for calculating total heat loss or temperature drop, for given thicknesses and types of thermal insulation (i.e. given values of t and k). Calculation of the values x and y for pipes and cylinders is quite straightforward, and strictly necessary for accurate results. It is only necessary to calculate the diameter ratio concerned (D_2/D_1), look up the Naperian log of this number and divide 0·5236 by this log, to determine x ($\pi/6 = 0{\cdot}5236$). $\pi \times D_2$ is readily calculated (or looked up in tables of circumferences) and 12 divided by this value gives y, whence substitution in the formula follows.

Calculation of the thickness of insulation required must relate to the conductance formula. The surface heat loss can be calculated on an approximate or 'guesstimated' size independently, if necessary, to deduct from a required maximum heat loss to arrive at a maximum permissible heat loss through conductance. Values can then be readjusted and recalculated as a check having arrived at a definite thickness figure. This is not necessarily optimum practice since a 'minimum' insulation thickness for a predetermined acceptable heat loss may not represent a minimum overall cost.

This particular problem is best tackled in another way. The cost of the insulation material, and the cost of fitting it, will represent a substantially linear curve, increasing with increasing thickness—Fig. 3. The corresponding heat loss, diminishing with increasing thickness of insulation—Fig. 4—can also be transformed into a direct charge or cost simply by relating the heat loss to the actual cost of producing that amount of heat.

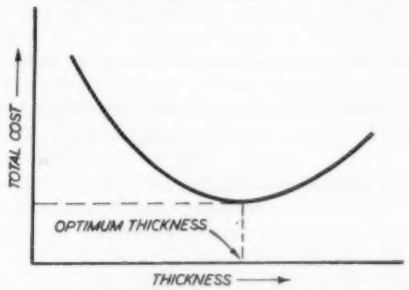


Fig. 5.—Overall cost (heat loss plus installation) plotted against thickness shows a minimum or 'optimum thickness'

If these two separate values are now summed and again plotted against thickness of insulation—Fig. 5—the result will be a true overall cost curve against insulation thickness, indicating a minimum at which the total charge levied against the cost of insulation and resulting heat loss will be a minimum. Obviously this corresponds to the most economic thickness of insulation for the job. Similarly, overall costs can be analysed for different insulating materials on the same basis to arrive at optimum thickness for these different materials and compare the corresponding costs.

Insulation efficiency can be assessed on the basis of

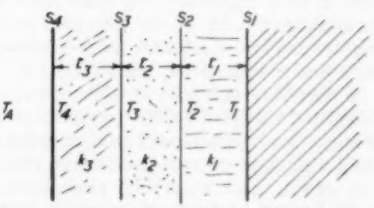


Fig. 6.—Analysis of composite insulation on plane surface

calculating the surface heat losses from the plain (uninsulated) surface as $f(T_{s1}-T_a)$ and comparing with the total calculated loss with insulation. Then

$$\text{efficiency} = \frac{\text{(heat loss from bare surface—heat loss when insulated)} \times 100}{\text{heat loss from bare surface}}$$

This efficiency figure is not, however, a true indication of the value of insulation and may, in fact, be misleading, particularly in the case of piping.

Another common problem involves the use of composite insulation where the thermal conductivity of the different materials employed varies throughout the

complete insulation. In each layer the heat transmission will remain equal to the temperature drop divided by t/k and in an equilibrium state the heat transfer through each layer will be the same and equal to that dissipated from the surface. Thus, assuming four surfaces S_1, S_2, S_3 and S_4, as in Fig. 6.

$$k_1(T_1-T_2)/t_1 = k_2(T_2-T_3)/t_2 = k_3(T3-T_4)/t_3 = f(T_4-T_a)$$

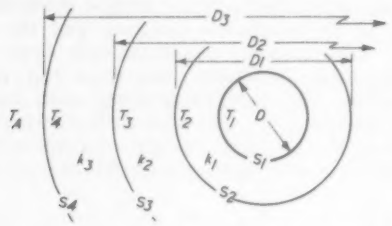


Fig. 7.—Analysis of composite insulation on pipes or cylinders

And in the case of pipes or circular lagging—Fig. 7—

$$k_1(T_1-T_2)/x_1 = k_2(T_2-T_3)/x_2 = k_3(T_3-T_a)/x_3 = f(T_4-T_a)/y$$

where $x_1 = (6/\pi)\ log_e\ (D_1/D)$

$x_2 = (6/\pi)\ log_e\ (D_2/D_1)$

$x_3 = (6/\pi)\ log_e\ (D_3/D_2)$

Andantex Speed Reduction Units

The Andantex speed reduction unit has been created specifically for the numerous applications demanding a sturdy and compact speed reducer for direct mounting on the driven shaft of a machine. Within limitations the unit can also be coupled to a motor shaft by means of a fixed or flexible type coupling to give an in-line drive arrangement.

Basically designed on the sun and planet gear system, the most revolutionary feature of the unit is the method of bonding the planet pinions to their respective shafts. If one set of planet pinions transmits a given force, then N planet pinions will transmit N times that amount. This, however, only obtains if the gear teeth bear upon each other simultaneously. In the patented method used, the gearing within the Andantex unit is pre-assembled. The pinions are mounted on their shafts and left free to rotate so that they can take up their natural position. Special adaptors are used in the position of the planet shaft bearings, thus enabling the planet gears to be pre-loaded and set in their correct position in relation to the central sun gears. This assembly now forms a mould which is pre-heated and liquid nylon is injected by a specially designed nylon press. The adaptors are then removed and the correct bearings inserted. At this stage the gears are in their correct working position.

All gears used in the manufacture of Andantex units are of the single helical type made from nickel-chrome steel, accurately cut, hardened and profile ground to very fine limits. This high standard of accuracy makes it imperative that the shafts upon which the gears are mounted, are in perfect alignment so that the gears are set with the minimum of play. In order to obtain this high degree of accuracy, special machines and tools have been designed.

Only ball and roller bearings are used; there are no bearings of bronze or brass, and the oil seals incorporated are of the highest quality.

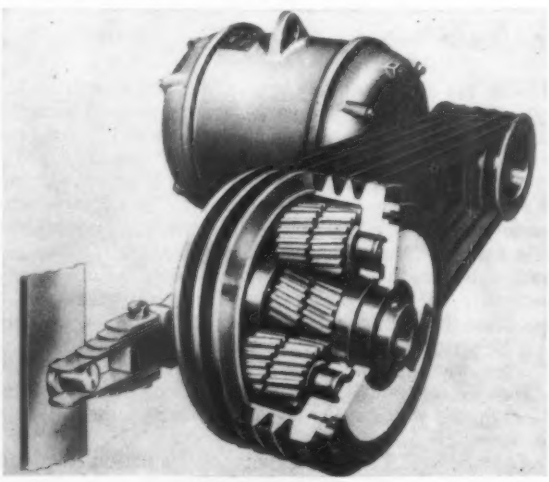
The essential immobilization of one of the sun gears is normally carried out by the use of a standard torque arm which is a simple casting fitted with leaf springs. Using this principle, several special accessories have been designed for use with the unit. These take the form of friction or slipping arms, torque limiters, friction clutches and an arrangement to provide two speeds. These accessories form an integral part of the unit itself and therefore take up very little extra space. In the case of the friction clutch, the control can be by hand or remote. The friction clutch also provides a very easy means of inching.

The unit also provides a method of reversibility not dependent upon the addition of extra gears or the crossing of a belt. The direction of rotation is governed by the gear ratio employed and can, therefore, be arranged as required.

Twenty-one set speed ratios are available ranging from 2·79:1 to 273:1 in cases where the driven shaft rotates in the same direction as the driving shaft. When the driven shaft rotates in the reverse direction, the range is from 1·79:1 to 272:1. In the largest case size, twenty-eight standard ratios are available in either direction from 3·22:1 to 481:1 in a forward direction and from 2·22:1 to 480:1 in the reverse direction.

The input drive can be taken by V-belt, flat belt, chain or open spur gears. Units are supplied ready grooved or crowned according to requirements. The units are made in various sizes to transmit torque loads up to 36,000 lb/ft. Designated by the degree of torque they will transmit, units are available in 16 sizes each of which can be fitted with any of the ancillary attachments, either singly or in combinations, to suit the transmission. The unit can also be used in conjunction with a variable speed unit to give either a variable speed range of say 6:1 or 10:1 or an infinitely variable speed from zero to say 2000 rpm. This involves using the unit as a differential.

Units are guaranteed for one year against any defect in manufacture, providing employment of the unit is within the recommended load limits and application. Of French origin, the unit is now being manufactured and marketed with increasing success in Italy, Spain, Germany, the U.S.A., and in Great Britain by Andantex Limited, Andantex House, Tamworth Street, Higher Openshaw, Manchester.



Andantex speed reduction unit

Balanced Centrifugal Pumps

How hydraulic radial balance is obtained in centrifugal pumps by the use of a double volute

FOR years centrifugal pump designers have been aware of an inherent defect in the principle of pumps of single volute construction, namely the unbalanced hydraulic pressure in the pump case at all diametrically opposite points around the periphery of the impeller throughout the pump's entire operating range. This unbalanced force acts radially against the impeller and

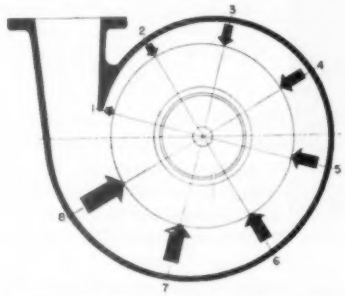


Diagram of single volute pump case indicating unequal pressure at opposite points around the periphery of the impeller

can be of sufficient magnitude to deflect the rotating element from its true position in the case, with the following results.

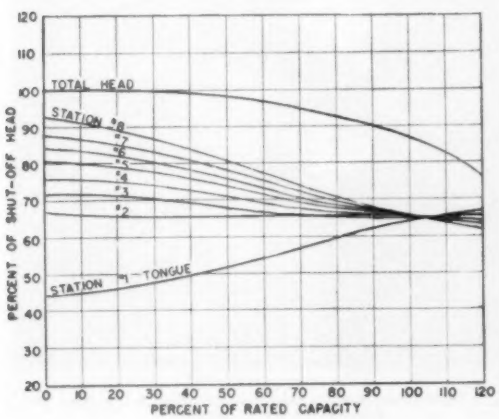
1. Wear or seizure occurs between rotating and stationary parts unless the pump is made with excessive clearance.
2. Packing or mechanical seals do not operate satisfactorily due to eccentric rotation of the shaft in the stuffing box. Frequent maintenance is required and there is a danger of dilution or contamination of pumpage owing to internal leakage of the sealing liquid.
3. Excessive bearing wear and maintenance.
4. Shaft deflexion necessitates frequent repair or replacement of the shaft or sleeve.
5. Jetting across causes wear on the rings and stage pieces.

Attempts have been made to balance the pressure in conventional single volute, multi-stage pumps by locating the throats of adjacent volutes alternately on opposite sides of the pump shaft, the theory being that unbalanced forces against one impeller would be cancelled out by an opposing unbalanced force against the impeller in the adjacent stage. It has been found, however, that staggered volutes create 'couples', which tend to force the shaft out of true axial alignment. This method of balancing also becomes undesirable due to the number of external cross-overs required when the number of stages is increased.

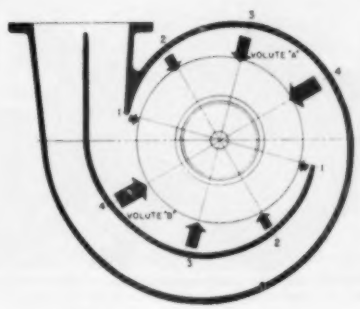
Under the terms of an agreement recently drawn up with The Bingham Pump Company of Portland, Oregon, U.S.A., pumps to the American company's design are to be manufactured and marketed by the Foundries Division, Penistone, South Yorkshire, of David Brown Industries Limited. The pumps concerned are of the double volute horizontal single-stage centrifugal type and the British company's market will embrace the whole of the Eastern Hemisphere, with the exception of Australia, New Zealand, and part of Japan.

With the development of the double volute construction which will be embodied in all David Brown-Bingham pumps, hydraulic radial balance has been established, eliminating deflexion of the rotating element throughout the entire operating range. This is achieved by making the double volute pump case in the form of two exactly similar volutes, each spanning half of the impeller circumferences. At any two points on opposite sides of the impeller, the shape and area of the adjacent casing and the velocity of flow therein are respectively equal. By virtue of this design, hydraulic pressure, acting radially against the impeller at any point, is balanced by an exactly equal pressure acting against the opposite side of the impeller—regardless of head, capacity, or speed at which the pump is operating.

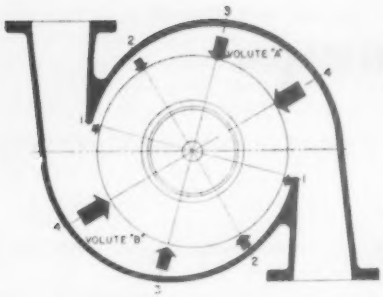
A special section has been set up at the David Brown Foundries Division to handle the manufacture of David



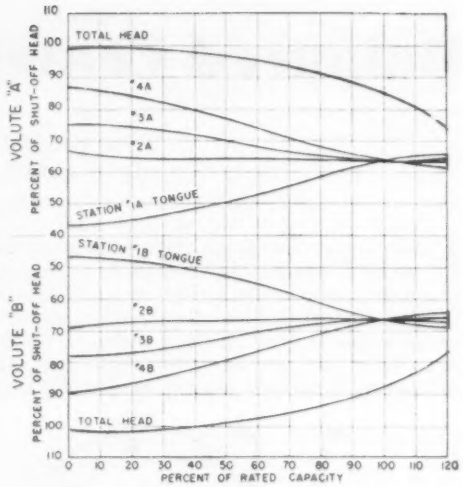
Left, chart showing the approximate relationship of pump capacity and pressure at equidistant points around the periphery of the impeller in a single volute pump case



Right, diagram of a "Double Volute" single discharge case of a single stage pump showing equal pressure on opposite sides of the impeller



Left, diagram of a "Double Volute" double discharge case of a multi-stage pump showing equal pressure on opposite sides of the impeller



Right, this chart shows the approximate relationship of pump capacity and pressure at eight equi-distant points around the periphery of the impeller in either single or double discharge "Double Volute" pump cases

Brown-Bingham pumps. Introduction of this new project is regarded as initiating a long-term project, the intention being to enlarge the range of sizes as the volume of production expands. This will in turn open up new applications, but for the moment the company is particularly concerned with the oil industry, which has been the biggest user of Portland-built pumps of this type.

In order to reproduce the results obtained by the American company, the David Brown division has laid down an exact replica of the Portland test equipment—necessary to ensure the requisite standards in every phase of manufacture. This equipment has been calibrated by the National Physical Laboratory to define both British and American standards.

Tests carried out on every pump before despatch are designed to show (a) the performance curve and (b) suppression data.

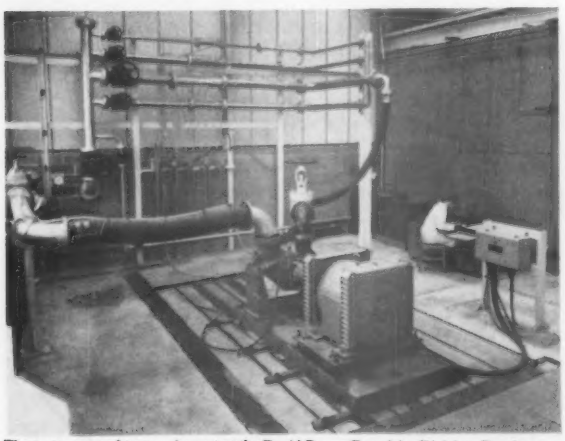
In order to obtain a performance curve, the output of the pump in gallons per minute is measured for various suction and discharge pressures. From this data, curves for dynamic head, brake horse power and efficiency are plotted against pump output in gallons per minute.

A suppression test determines the net positive suction head at which a pump will operate for a given output. The pump output is kept constant and discharge pressure measured for various suction heads. These are obtained initially with the natural head of the suppression tank and subsequently by partially closing the suppression tank outlet-valve and evacuating the tank via a vacuum pump, which is shut down before readings are taken. Readings for five or six different outputs, together with efficiency and dynamic head, are plotted against the suction head for each output in gallons per minute.

The plant is capable of carrying out performance tests and suppression tests of centrifugal pumps up to a capacity of 5,000 gpm against a head of 600 psi. To carry out these tests motors are available up to 500 hp at 3000 rpm.

The electrical control gear, supplied by Messrs. Allen West of Brighton, consists of a main control panel incorporating an auto-transformer starter for the motors in the 50 to 500 hp range and a direct on-line starter for motors below this horse power. Included in the panel are tapped current transformers connected to a wattmeter accurate to within $\frac{1}{4}\%$. For convenience, this wattmeter is fitted into a desk adjacent to the hydraulic equipment. The electrical supply to the motors is taken from the control panel to a terminal board on the test stand floor. This makes sure that the flexible cables to the driving motor are as short as possible.

A 5,000 gal capacity tank holds the water for testing the pumps. This tank can be pressurized to 100 psi or can have a vacuum approaching 29 in. Hg to give an artificial suction head to the pump under test. It is by this means that the suction head is varied to find the net



The test room and test equipment at the David Brown Foundries Division, Penistone—an exact replica of that in use at The Bingham Pump Company of Portland, Oregon, U.S.A.

Assembling a David Brown-Bingham pump unit for testing at the David Brown Foundries Division, Penistone

positive suction head at which the pump will operate for any given output. Measurement of the capacity of the pump under test is done by venturi meters of which there are four sizes. The sizes are 2 in., 3 in., 4 in., and 6 in., and the appropriate size is selected according to the size of pump being tested. These venturi meters were manufactured from drawings supplied by the Bingham organization. The venturis and manometers have been calibrated by the National Engineering Laboratory at East Kilbride to an accuracy better than ¼%. To obtain. maximum accuracy, the discharge pressure of the pump is measured by a dead weight tester which can give an accuracy of within one foot head of water.

The design of the David Brown-Bingham pump is such that the rotating elements can be replaced on site without disturbing the main pipe connexions to the pump. This means that users can carry spares and do not need to hold stand-by units.

As the British and American companies are both manufacturing to the same limits, the rotating elements will be interchangeable. It is, in fact, the intention that spares components and replacement units for all users in the Eastern Hemisphere will in future be supplied from Penistone.

Manufacture of single-stage process pumps is the David Brown Foundries Division's second venture into fields which have previously been exclusively American. The company already produces oil pipeline valves in a range of sizes up to 36 in. pipe diameter and has fulfilled several contracts in the past three years.

Fluon Valve

A new plastics valve introduced by the Chemical Pipe & Vessel Company Limited, Godstone Road, Kenley, Surrey, can be used for corrosive and hot liquids.

The valve is in Fluon. Apart from its uses in connexion with hot corrosive liquids, it can also be used for strong sulphuric acid, strong nitric acid and hot ferric chloride. It will withstand temperatures up to 200° C. and is immune from corrosion by any known chemical. It is workable at much higher temperatures than is possible with rubber-lined valves. The price for a ½ in. valve is about £35.

The valve is one of a range of corrosion-resisting valves made by C.P.V. up to 2 in. bore. They are available with flanged ends, and in some cases screwed ends for low pressure lines. The range includes fine adjustment valves, pressure relief valves, on- and off- valves, and non-return valves.

Linear Bearings

A Swiss company Messrs W. Schneeberger, have developed roller and ball linear bearings to replace conventional slides. These bearings consist of hardened and ground tracks and crossed roller chains or caged balls. The tracks, of special steel alloy and heat-treated to give them great hardness and perfect stability, are made in six standard sections to the length and with fixing holes made to the customers' requirements. In the smaller sections they are also made in stock length sizes in increments of 50 mm or 100 mm with holes at standard pitches, partially threaded and partially counterbored. Tolerances are of 0.00001 in. per every 2 in. of length. The rollers or balls have to be of matched sets to the most precise tolerances, achieved by a special technique.

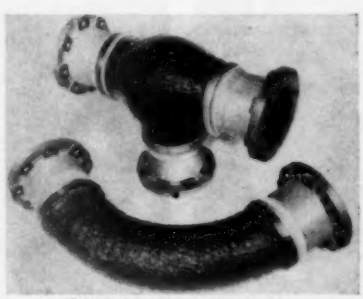
An example of a new Swiss linear bearing with crossed rollers

To meet the needs of designers requiring a slide with a long stroke in relation to the length of slide, a special type has been evolved. This consists essentially of a crossed roller chain made endless, supported by pulleys and running on tracks. This recirculating bearing is advantageous where the slide itself is shorter than the stroke and where very long strokes are required.

Sole distributors of these bearings for the U.K. and Commonwealth are Engineering & Scientific Equipment Limited, Coronet House, 287/9 Old Street, London EC1.

Bristol Pipe

Bristol pipe, made by Bristol Aeroplane Plastics Limited, Bristol, is a complete pressure piping system of thermosetting epoxide resin reinforced with high strength glass fibres and is produced in sizes ranging from 6 in. to 15¼ in. bore. Piping is supplied in standard 20 ft lengths, with a standard range of ancillary fittings—tees, bends and flanges. The pipes can be either flange-jointed or bonded. The bonded-joint method is favoured for permanent pipeline installations, and Bristol has developed special mobile equipment enabling pipes to be rapidly and efficiently bonded *in situ*.



Bristol glass reinforced resin pipes

Bristol pipe is soon to go into large-scale production in a new automatic pipe winding plant now being built at Bristol, following several years of research and development testing and the proving of manufacturing techniques in a pilot installation. The pipe is highly resistant to corrosion and is virtually unaffected by soils, sea-water, demineralized water and the majority of dilute acids and alkalis, even up to temperatures of 120°C. As the epoxide resin glass filament structure is also a non-conductor of electricity and not subject to electrolytic action, pipes can be safely buried in the ground without any form of corrosion protective coating or cathodic protection. The freedom from corrosion defects and build-up of wax deposits on the mirrorlike interior surface ensures constant carrying capacity with low friction losses and minimum pumping costs. By virtue of its corrosion-resistance, the pipe lowers maintenance costs, improves operating efficiency and prolongs pipeline life, and is thus suitable for a wide range of applications in the chemical, oil, atomic energy, gas and shipping industries. Bristol pipe is, for the same operating pressures, approximately one-quarter the weight of steel components, but is as strong as steel pipe of comparable wall thickness but approximately ten times more flexible.

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Press Quenching Under Exact Control

Quenching of steel parts emerging from a furnace must be carefully supervised in cases where distortion is not permitted. Even when the work-piece is clamped in a press and quenched by a flow of oil, it is important to start the quench at the right temperature and continue it at the correct rate to ensure that the best metallurgical and physical properties are maintained and distortion avoided.

An example of such work occurs in the heat treatment of crown wheels and other gear parts at the Ford Motor Company Limited, Dagenham, where control of the quenching action on twelve Gleason machines is now performed automatically by electronic controllers, using a Radiamatic detector as the primary sensing element.

The period between the removal from the furnace and the start of the quench is variable, and human judgment has been replaced by electronic accuracy to meet the demand for closer tolerances in quality quench press work. The instruments used are ElectroniK controllers supplied by Honeywell Controls Limited, and the primary sensing element is their Radiamatic compensated radiation detector.

Heat treatment is carried out in twin track furnaces supplied by International Furnace Equipment Company Limited, controlled by Honeywell instrumentation and additionally incorporate the Protectoglo flame failure alarm system on the gas curtain controls.

The radiation detection system was at first experimentally tried out for measuring the product temperature only, but the presses now also have their full operating cycle started off automatically by means of these instruments when the correct temperature for quenching is reached.

The detectors are fitted vertically on the upper part of the machine. The lens of the detector focuses radiant energy from the work-piece on a radial assembly of thermocouples connected in series. The smallness and quick response of this assembly make it a very exact means of appreciating temperatures and faithfully converting them into an electrical voltage that can be measured by a distant instrument. This method of detection is ideal in conditions such as this where vibration, shock, high speed of process and high temperature preclude the use of normal thermocouples.

A distant controller instrument is associated with each detector. The controllers are continuous balance instruments having circular clear vision scales which give a non-permanent indication of temperature at the detector head. Immediately the work-piece is placed in the machine, the instruments begin responding to the voltage from the detector and the scale reading rises to about 1550° F where it meets the descending temperature of the work-piece which emerged from the furnace at approximately 1610° F; the scale reading falls with the cooling of the work-piece until approximately 1510° F; a contact in the instrument then causes the work-piece to be horizontally moved and the whole machine cycle begins.

Built into the control circuit is an element to prevent the press operating if a gear is inserted at below the quenching temperature.

The ElectroniK instrument itself operates on the potentiometer principle, the voltage from the Radiamatic being received across a slide wire and compared with a standard voltage; the difference in the voltage is conveyed through an amplifier system to a motor which moves the slidewire contact and places the circuit in balance again. At the same time the scale is made to rotate. This is a continuous procedure, and in the present application it goes on until a predetermined point is reached when cams behind the circular scale operate a mercury switch contact which indirectly causes the machine to clamp and the first oil inlet valve to open. The accuracy of this measurement is exceptionally good. The instrument calibration is within 0·25% of scale span.

Left, some of the Gleason quench presses at the Ford factory. Quenching temperature is controlled by Honeywell instrumentation. Right, close up of a gear wheel in a Gleason quench press. The Radiamatic pyrometer is shown fixed to the machine above the work piece

The three oil valves on the Gleason machine, designated A, B and C, give oil flows on a 16 in. machine varying from 40 gpm for a simple A flow up to 210 gpm for a combined A-B-C flow; on the large 26 in. machines the flow varies from 50 to 300 gpm. Once the controller has initiated the machine cycle, the timing is carried out within the machine and a typical three stage quench might have timings of 15, 15 and 30 sec the first stage being quite gentle to allow the clamping system every chance to settle prior to the heavy douches in oil.

Lagging for Conveyor Drums

A method of lagging conveyor drive drums which will give 100% drive in very wet and/or slimy conditions has been devised by Messrs. J. Gibbon, Mechanical Engineer, Durham Divisional Headquarters, and F. Burgon, No. 5 Area Mechanization Engineer, Durham Division of the National Coal Board. It has already been adopted widely in the Division and is proving very successful, particularly on wet coal-faces.

The idea is to mould a lagging of suitably prepared fire-resistant neoprene directly on the steel case of each drum of any conveyor drive unit. It is necessary for this work to be done by a manufacturer with experience in this field of equipment. After the moulding has been completed the surface of the neoprene is ground down until the required drum diameter is reached, leaving at all times a thickness of at least $\frac{3}{8}$ in. neoprene. A special tool is then applied to the surface to give a patterned tread—in Durham Division an equal diamond pattern has proved very suitable.

Experience has shown this neoprene lagging to have a life six times greater than any other method used.

Iron Foundry Scrap Reduction

A scientific investigation of scrap problems in a British iron foundry has saved £24,000 a year. The management were concerned with the losses due to bad castings which had been running at a level of over 20% of production and were on the increase. When they decided to have an investigation the figure was over 24% and in some batches 60% of production was scrapped. The improved methods resulting from the investigation, combined with the controls introduced, reduced the scrap levels by 16% to 8% of production. This was equivalent to a saving of £24,000 a year. The investigation was conducted by Production-Engineering Limited, management consultants, and the success of the operation was due largely to close co-operation between consultants and the foundry's management. The foundry was laid out with a mechanized conveyor and a supply of green sand to a number of jolt machines by conveyor belt. Cores were made of oil-bound sand. Castings were of a relatively limited number of types, varying from approximately 10 lb to 40 lb. The total output was 500,000 a year and while some castings were in continuous production, other types were made in batches of 200 to 400. The main phases of the investigation were:

1. Analysis of past returns to determine the main causes of scrap and which castings were most affected.
2. Preparation and implementation of an experimental programme to determine the causes of scrap.
3. Application of improved methods resulting from the experimental work.
4. Introduction of controls to signal, for each of the major faults, when remedial action was necessary.

An analysis made of past returns to show the main reasons for scrap, both for the total production and for each type of product, revealed that scrap increased in proportion to diameter and as the cube of increase in length. Scrap rates for various faults were also graphed on a time scale to show the trend over a period. One matter of particular interest was where, in order to reduce cold shut, pouring temperatures had been increased, it was noted that rejects due to dirt had increased simultaneously.

Each fault, starting with the most important, was taken in turn and every effort to reduce the loss was explored with the management. In the light of foundry conditions, those with the most promise of success were selected and experiments prepared to show what effect each change would have on the scrap rate.

To achieve valid results it was necessary to arrange in each test that a control group should run alongside each experimental group. For example, in checking whether vent holes in the green sand would reduce blow holes, of each two boxes produced during the experimental run one box had vent holes while the other had no vents. This ensured that all other factors which also could have had an influence on blow holes—moisture content of sand, permeability, dryness of cores, packing of sand, etc.—were kept constant.

A second example was the experiment to determine the effect of eccentricity of the centre boss of castings which resulted from cores not being positioned properly, not being straight or moving in the green sand. A large percentage of castings with this fault was being rejected since, when machined, they did not clean up. A number of batches were sent to the machine shop each of which had a different degree of "sliding" varying from virtually no sliding to extreme eccentricity.

On machining it was found that approximately the same proportion of castings had been rejected in each batch due to sliding, indicating that the fault lay in machining. A redesigned chuck virtually eliminated rejects due to this fault.

A routine of graphing scrap against period for each of the major faults was introduced. Control lines were established at points considered to be the maximum allowable for each particular fault. When scrap levels approached or crossed the control line this indicated the need for action to reduce the loss.

While a number of experiments gave inconclusive results, the reasons for faults were in many cases obtained. In other cases test results showed where further experimental work should be done. The changes in methods introduced as a result of the experimental work and the results obtained are given briefly below.

Fault	*Percentage Scrap*	*Changes in Method and Results*
Blown	4·6	Correct baking of cores reduced scrap substantially.
Broken	4·3	Breakages were shown to result from the handling of castings when hot and also the use of rumblers. With handling of castings cold and the use of a Wheelabrater instead of rumblers, this fault was eliminated.

Sided	4·2	The following changes were made: (i) Core boxes were modified and renovated (ii) Baking of cores was done correctly (iii) The core was located more centrally in the green sand (iv) A modified machining chuck was fitted to automatic lathes. The fault was virtually eliminated.
Slag	3·0	Changes made were as follows: (i) Use of a teapot spout on ladle (ii) Use of larger brush on mould (iii) Operators were instructed not to empty ladles.
Machine		Reductions in scrap were obtained.
Scrap	1·9	The use of a modified machine chuck virtually eliminated this fault.
Cold Shut	1·9	Metal was poured at a higher temperature to reduce this loss.
Swollen Dirt Crushed Drawn	4·3	Sundry improvements made.
Totals	24·2%	Scrap reduced to 8%.

Water-cooled Welding Fixture

An interesting welding technique has recently been evolved by James H. Randall & Son Ltd., of Paddington Green, London, for the construction of over one thousand welded platforms forming part of the new Bank Station Trav-O-Lators. These "moving pavements", designed by the Otis Elevator Company Limited and for whom Randalls, as subcontractors, are manufacturing the platforms, are now being installed at the Bank Station of the Waterloo and City Railway which forms part of the Southern Region of British Railways. This installation is of a heavy railway design and will be the first of its type in Europe.

The Trav-O-Lators are designed and constructed on similar principles to a normal escalator, operating an easier angle of incline, so that the series of moving platforms each 40 in. × 16 in., form a smooth inclined surface 300 ft long, moving at a maximum speed of 2 mph on a 1 in 7 slope rather than a series of steps.

Two of these units are being installed side by side in a 16 ft 6 in. dia tunnel, and when in operation, towards the end of 1960, the 40,000 passengers who now clamber up and down the existing series of congested and awkward subway steps every day will be given a comfortable two-minute ride.

The platforms, Fig. 1, are fabricated from $\frac{1}{16}$ in. steel plate, folded into a box section with two ribs of $\frac{1}{16}$ in. plate and ends of $\frac{1}{4}$ in. bright steel plate welded on. Die-cast ribbed sectional treads are then bolted on to this platform unit.

Fig. 1.—Platforms for the Trav-O-Lator as they will appear in use, showing, in foreground, underside of a platform, and method of bolting treads

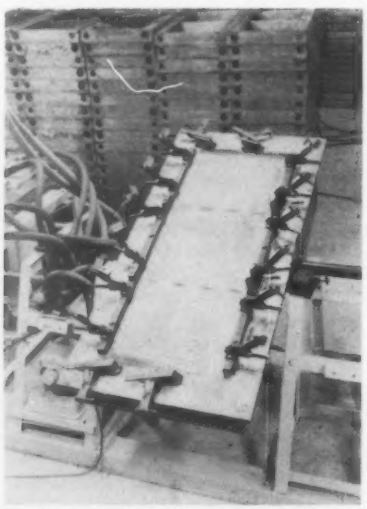


Fig. 2.—Fixture for welding platform end plates, showing clamps and pivot arrangement

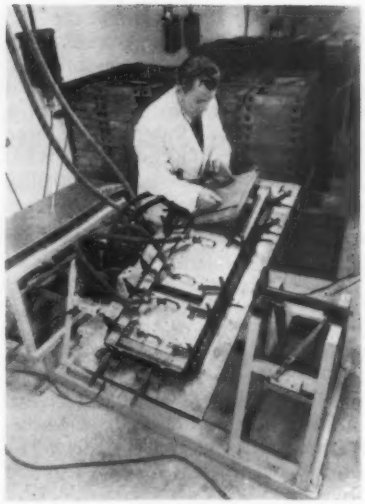


Fig. 3.—Welding fixture with platform in position, showing the three water-cooled copper tanks for heat dispersal, being fixed into position by Mr. N. Ford, Works Manager at Randalls, who designed the fixtures

An unusual degree of accuracy of manufacture is required in the production of these platforms. The specification demands a dimensional tolerance of 0·005 in. on the overall width of 44 in. and there is a 0·003 in. tolerance on the 25 holes which are punched in the platform in one operation before folding takes place. Two of these holes are used for locating purposes in every subsequent operation, including folding.

An essential requirement is that there is no distortion due to welding so that when the die-cast aluminium treads are attached they form a perfectly flat surface. The bearing housings are welded to the platforms to support the axles which form part of the endless chains. A second fixed axle is welded into position to carry the trailer-wheels on which the platforms run. Here again freedom from distortion is important.

It was necessary to design and construct a special fixture to hold the platform and its end plates during welding so that the heat involved while making a 22 in. weld at each end of the platforms could be evenly dispersed without causing distortion.

This fixture, Fig. 2, consists of a surface plate pivoted to a fabricated frame so that it can be locked in convenient working positions. Toggle clamps attached to the surface plate hold the main platform sheet and its end plates in their appropriate positions.

To assist heat dispersal, three rectangular copper tanks, through which water is circulated via flexible hoses by an electrically driven pump, are clamped inside the platform before welding begins (Fig. 3) and in addition there are two smaller water-cooled tanks built into the underside of the surface plate immediately beneath the two main welds. This method of water cooling, (making use of a Randall Aqua-sava water-cooling tower) together with the fact that the large mass of metal embodied in the surface plate absorbs and evens out any heat remaining, results in the quick and efficient production of distortion-free units.

The finish of the platforms includes bonderizing and a coat of black matt paint. The interior is sprayed with 3 lb of Aquaplas to minimise noise due to drumming when in operation.

Speeding up Buying Office Procedure

A simple, but extremely practical system of purchasing document file collation has been introduced at the Barkingside factory of Kelvin & Hughes Limited, designed to speed up the transit of goods through the goods-in stores and reduce the amount of paper work required to control such movement.

Designed by the chief buyer, Mr. K. A. B. Gilfillan, the system consists of two angled banks of standard suspension pocket files arranged on either side of a rail-mounted desk and chair in such a way that the order clerk has complete supervision and is able to reach and select any one of some 500 files from a seated position. Transfer of documents between the goods-in store and buying office is by means of a pneumatic carrier.

For some years the Barkingside factory has used continuous stationery for purchase orders, these are prepared on electric typewriters a feature being that the majority of the orders cover one item only. In this way, when the order is typed, six copies are obtained, including the buying office record card for the item. The new system was devised as an extension of this method to reduce the number of documents required to cover goods received into the factory and to speed up the movement of the goods through the receiving stores.

Basically, it utilizes some of the existing order copies to accompany the goods after arrival at the factory, into goods-inwards inspection, then main stores, or the department ordering. Only in the case of second, or subsequent deliveries from an order, or for capital goods and certain other items, is it necessary to raise a goods-inwards note to accompany the goods. Except for the certain orders just mentioned, the costing office receive their copy of the order stamped with the goods-inwards inspection certificate of acceptance, thereby enabling the supplier's invoice to be cleared with the minimum of delay. For the second or subsequent deliveries and the exceptions mentioned above, the costing office still receive a goods-inwards note, certified by inspection, to clear an invoice; the copy order being already in their possession. By transferring the clerks dealing with the advice notes of incoming goods from the goods-in warehouse to the buying office, the time taken to clear queries has been considerably reduced, as all paperwork is in the one office.

In order to operate the new system efficiently it was necessary for the order copies (four copies stapled together) to be readily accessible to the order clerk; the buyer retaining the fifth copy as well as the record card. The order copies are held in two banks of six rows of Roneo pocket files into which are placed folders labelled in alphabetical order, containing the loose copy orders. One bank contains the "live" orders and the other the completed orders. The order clerk sits at a rail-mounted desk between the two banks of files, so that she has easy access to any folder in either bank. Copy orders from the order typist or from the buyer's clerk, are inserted into the appropriate folders from outside the banks, to obviate any interference with the order clerk. To avoid delay in transferring the advice notes from the goods-inwards store and copy orders and other documents to the stores, a pneumatic carrier system has been installed between the order clerk's desk in the buying office and the goods-inwards store. In detail the system works as follows:

The goods-in storeman, after removing the supplier's contents or advice note, checks the quantity and description of all goods received against it. A different coloured pencil is used by each storeman to simplify identification in the event of subsequent queries. The advice note number, order number (if quoted), and date received are written on the label and the advice note is sent to the order clerk. Any discrepancies are indicated on the advice note before being sent to the order clerk. If no advice note is received with the goods, a temporary advice note is made out, giving all the relevant details.

The order clerk, on receiving an advice note from the goods-in storeman, looks for the relevant order copies in her file. If the advice note covers a complete or first delivery against an order, the four copies of the order will be in the live file. The order clerk checks the advice note with the four coloured copies of the order (blue, white, pink and green) ensuring that the description and quantity on the advice note tallies with the order. She also checks that the order number, if quoted, is correct and the delivery is in accordance with the terms of the order. The number of the supplier's advice note is entered on the goods-in (pink and green) copies only. If it is the first of a multiple delivery, the order clerk stamps each copy order with the delivery stamp and writes in the quantity delivered and the quantity outstanding. If the advice note relates to a second or subsequent order, a blue copy only will be attached to the advice note from previous deliveries. The details are checked on the advice note with the copy order as above and stamped with the delivery stamp as before and the new quantity delivered is written in, with the quantity outstanding, if any. The new advice note is stapled to the blue copy, leaving the earlier advice note also attached and set aside for a goods-in note to be made out.

If the order clerk is doubtful of any details on the advice note, the documents are immediately sent to appropriate buyer for clarification. The advice note is stapled to the copy order as usual but one corner of the advice note is turned back and the query written in.

The copy orders are distributed as follows:

Blue copy with the supplier's advice note to the buyer's clerk.

White copy to the progress department for production items.

Pink and green to the goods-in store to accompany the goods.

Designing for Spot Welding Aluminium Alloys

Main design considerations as regards alloys and machines used, the process itself and the resultant mechanical efficiency of the joint made

IN designing for the fabrication of any metals, the general principles of design must necessarily be modified to suit the characteristics of the particular metals concerned. With regards to aluminium alloys it must be remembered that they have high electrical and thermal conductivities, thus very high capacity welding machines have to be used, with the special methods for producing and controlling the currents that their use involves; the temperature range between the solidus and the liquidus is small, which calls for close control of energy input; there may be present a high-resistance film of surface oxide, which has to be removed from faying surfaces and surfaces in contact with the electrodes; aluminium tends to alloy with copper, which necessitates frequent cleaning of the electrodes; and several aluminium alloys are heat treated before use whereas others are used after cold working—in both cases local increase in temperature at the weld can reduce the mechanical properties of the metal.

Thus suitable machines must be used and, even more important, the process must be correctly controlled, the surface properly prepared, the parts fitting closely before welding, and the general design of the work must be suitable to the metal involved. Successful spot welding of these alloys therefore depends on surface preparation, giving uniformly low contact resistance; correct positioning of the work to the machine—with the axis of the electrodes at right angles to the surfaces to be welded; correct machine settings; adequate control, and correct design.

Table I.—DATA FOR DETERMINATION OF MINIMUM SPOT WELDING SPACING

Thickness		Max. Weld Diam.	Max. Surface Indent*	Min. Practical Welding Spacing	Min. Dist. Between Rows
s.w.g.	in.	in.	in.	in.	in.
24	0·022	0·16	0·0023	$\frac{1}{8}$	$\frac{1}{4}$
20	0·036	0·19	0·0028	$\frac{5}{32}$	$\frac{5}{16}$
18	0·048	0·23	0·0033	$\frac{1}{4}$	$\frac{3}{8}$
16	0·064	0·28	0·0038	$\frac{5}{16}$	$\frac{7}{16}$
14	0·080	0·35	0·0046	$\frac{3}{8}$	$\frac{1}{2}$
12	0·104	0·39	0·0050	$\frac{1}{2}$	$\frac{1}{2}$

*The best practice indicates that maximum surface indentation should not exceed 10% of the sheet thickness for work such as the outer skins of components.

Table II.—RECOMMENDED MINIMUM WELD SPACING, EDGE DISTANCE AND CLEARANCE

Thickness		a	b	c	d	e
s.w.g.	in.	in.	in.	in.	in.	in.
24	0·022	$\frac{7}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{7}{16}$	$\frac{9}{16}$
20	0·036	$\frac{1}{2}$	$\frac{5}{32}$	$\frac{5}{16}$	$\frac{1}{2}$	$\frac{9}{16}$
18	0·048	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{9}{16}$
16	0·064	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{9}{16}$
14	0·080	$\frac{1}{2}$	$\frac{5}{16}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{9}{16}$
12	0·104	$\frac{9}{16}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{9}{16}$

a Minimum edge distance.
b Minimum spot spacing.
c Minimum distance between rows of staggered welds.
d Minimum overlap flange width or "flat" required.
e Minimum unobstructed area required to place a weld diameter.

Above Tables: Aluminium Development Association.

Spot and seam welds in aluminium alloys involve fusion at the metallic interface; it may in due course be possible to weld thus without melting the metal, but this process has not yet been commercially developed. When, after application of the electrodes to the work, the current begins to flow, the metal softens and the area of contact is quickly enlarged, the resistance of the oxide film being correspondingly reduced. In order to avoid shrinkage cavities, cracks and other undesirable effects, the electrodes should be allowed to follow up the deformation of the metal and it is also sometimes advantageous to increase the applied pressure of the welding current, either at the end of or during its passage.

Weldability depends mainly on the conductivities of the alloys and the difference in the melting points. As aluminium alloys have fairly high conductivity—about half that of copper—high welding currents have to be used. Most of the wrought aluminium alloys in general use in this country in the form of sheet and strip can be spot welded satisfactorily providing that care is taken to obtain the correct conditions of welding. Alclad (HC14,15) is generally easier to weld than duralumin (HS14,15), and aluminium-magnesium alloys (NS3) are easier to weld than either Alclad or duralumin.

Machine capacity and electrode pick-up cause difficulties in the welding of commercially pure aluminium, but these can largely be overcome in condenser-type machines, which are better than any other type when welding high-conductivity aluminium. High-tensile heat-treated alloys generally give greater consistency of weld strength than low-tensile alloys. Heat-treated alloys tend to show cracks and porosity in the weld more than non-heat-treated materials, and shrinkage cracks in welds are confined to copper-bearing alloys.

Fully heat-treated alloys can be spot welded together, one with another, fairly easily, but welding heat-treated to fully annealed or cold-worked material is rather difficult, as also is spot welding aluminium or its alloys with higher melting points than duralumin to other such alloys than to those of similar physical characteristics. Although a heavy section of high conductivity can easily be welded to a thin section of low conductivity, it is difficult to weld a thin section of high conductivity to a

Table III.—THE SPOT WELDABILITY OF ALUMINIUM ALLOY SHEETS OF EQUAL THICKNESS

Alloys	Cu*	S1C	NS3	NS4,5,6	NS7	HS14	HS15	HC14	HC15
S1C	60	D	D	D	D	D	D	N	N
NS3	45	D	G	D	D	D	D	N	N
NS4,5,6	40	D	D	G	G	D	D	D	D
NS7	30	D	D	G	G	D	D	D	D
HS14	35	D	D	D	D	G	G	G	G
HS15	35	N	N	D	D	G	G	G	G
HC14	35	N	N	D	D	G	G	G	G
HC15	35	N	N	D	D	G	G	G	G

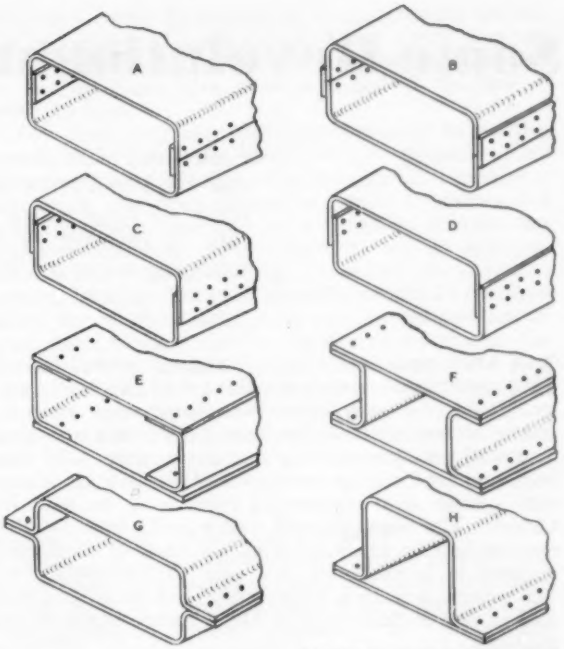
*Cu: Percentage conductivity compared with copper (100%).
G: Good; D: Difficult; N: Not recommended.

heavy section of low conductivity. Up to a thickness ratio of 2 to 1, Alclad sheets of different thicknesses can be welded together, but when the ratio is 3 to 1 the thin sheet is likely to become indented; and when one sheet is six or more times thicker than the other, welding should not be attempted.

Spot welding saves weight, assembly time and labour; it gives a highly rigid structure and, by improving surface flatness and smoothness, it decreases air-skin friction—important design factors. Design must always be aimed at obtaining maximum structural joint efficiency and maximum production efficiency; the parts must be easily and rapidly assembled by the production department. A spot weld develops its greatest strength in shear load, thus the work should be designed so that the welds are in shear and the sheets in tension.

Spot welds spaced nearer to each other than the distances shown in Table I will be reduced in strength owing to current shunting—the short-circuiting effect of adjacent spot welds on the spot being welded; up to this point and providing that the energy output for the machine is sufficient, the strength per lineal inch of joint will increase as the spacing is decreased; in design, the strength of the joint as a whole is more important than individual weld strengths. There must always be plenty of landing between spot welds and the edge of the sheet, and minimum edge distances are shown in Table II in which the last column refers to the use of straight, not offset, electrodes.

The shear strength of a group of spot welds is knx, when n is the number of welds, x the minimum shear strength and k a constant which may be equal to, or more or less than unity; for design purposes in aluminium alloys k should be taken as 0·8. The maximum joint efficiency obtained with spot welding Alclad is 100% the average being 93%; the maximum stress developed is nearly 62,000 psi, the average being just under 60,000 psi. The ideal spacing for spot welds in Alclad 0·04 in. thick (19 swg) is ½ in.; for maximum efficiency and economy in production, high-strength spots are better than low-strength spots; wire-brushing is better than chemical cleaning; the presence of cracks visible only by means of X-rays is not critical; welds made with a.c. equipment are stronger than those made with d.c.; and, in stored energy machines, current wave-shape has practically no effect on joint efficiency.



(*Aluminium Development Association*)

Diagrammatic examples of joints suitable and unsuitable for spot welding. In (a), (b), (c), (d) and (e) welds cannot be made, but (f), (g) and (h) are accessible, particularly (g) and (h)

Unless welds tested are structually identical and of the same shape, fatigue strength cannot be related to static shear strength; but regularly-shaped welds have better resistance to fatigue than irregular welds, and rivets are about twice as strong in fatigue as spot welds of the same size. All welds should be readily accessible to the electrodes—vertical approach to the joint on either side being unobstructed. Examples of good and bad types of spot welding joints are shown in the accompanying sketch.

Versatile Steel Shelving

A product accompanied by a service which is receiving much favourable comment is the adjustable steel shelving made by N. C. Brown Limited, Eagle Steelworks, Rochdale Road East, Heywood, Lancashire, who send the customer an assembly instruction sheet with acknowledgment of order and effect local delivery in two days and to any part of Great Britain in seven to ten days. The shelves, which are 6 ft high, 34 in. wide and 12 in. deep, are open on all sides and rendered rigid by gussets which are used in the top and second-bottom shelves only. The price ranges from £3 15s. 0d. for a single set to £3 7s. 6d. per set for quantities of 100 or more.

The company make a wide range of storage equipment in the form of ticketed drawer cabinets of all sizes and combinations, compartment bins in numerous shapes and sizes and in combination with drawer sets, tool boxes and lockers, clothes lockers, "Wallmaster" and "Stockmaster" hinged tray cabinets, and a full range of office furniture and filing equipment.

Hot Water Circulators

The extension to the range of the three existing sizes (1½ in., 2 in. and 3 in.) of Fullway-Direct-in-Pipeline circulators made by Saunders Valve Company Limited, Drayton Street, Wolverhampton, has been made possible by the adaptation of the Safrax circulator body. The basic design is generally the same as the existing CCE pattern but the branch connexions are fitted with unions screwed internally and the impeller is retained by a nut. The screwed connexions are for sizes ¾ in., 1 in. 1¼ in. and 1½ in. These additional sizes are fitted with ⅛ bhp sleeve bearing motors running at 1430 rpm and suitable for either 230/250 volts single phase or 400/440 volts 3 phase electric supply.

The ¾ in. and 1 in. sizes are for duties up to 12 gpm. 1¼ in. and 1½ in. for duties up to 16 gpm. The three flanged models provide duties up to 110 gpm.

The suitability of the smaller sizes for domestic hot water supply systems will be appreciated as these, as well as the larger sizes, are available in all gunmetal construction when required.

Some Revolutionary Developments

Experience has shown that between the discovery of a new principle and its application there is a considerable time-lag and it is worth while to keep watch on what is happening. There are at the present time a number of revolutionary advances in prospect and in the following notes a few of these are briefly outlined

MANY years ago a French engineer named Basset developed a means of making steel direct from ore by the aid of a rotary kiln. His scheme never came to much, but now in the United States a pilot plant operating on a different system, but also using a rotary kiln, has been running for three years successfully, with the result that a large new commercial plant is to be built in Canada. The object of the system is to facilitate the manufacture by small consumers of steel of their own material at much lower cost than that of buying it. The process is really a blast-furnace laid on its side, but coal is used instead of coke, and a rotary kiln replaces the stack.

Another development which may have great importance is the new rotating combustion engine for aircraft, automobiles, lorries, and possibly even industrial equipment. These engines are going into production next year in both the United States and Germany. The disadvantage is said to be the decline in output as engine size increases; but whether this be true or not, the fact remains that the engines are coming.

Tremendous world changes will inevitably occur if the new methods of obtaining fresh water by freezing come into regular use. Already one large salt water conversion plant in operating in the Dutch West Indies. Israel is to build a 1·9 million litre unit during the present year. This latter plant de-salts water by first freezing it to form ice crystals of pure water, and then segregating the crystals from the salt trapped between them. This takes less energy than distillation and reduces scale and corrosion. Distillation plant is, however, being made of improved type for salt-water reclamation of fresh water. Some of these distillation plants, such as that of the Dutch West Indies, use the process to produce electricity at the same time. Pump demands will increase enormously when these systems are general.

Blow moulding, originally applied to manufacturing the kind of plastic bottles that can be squeezed, is being developed on a large scale as an alternative to injection moulding and thermoforming of plastics. In Europe, America and Japan fully automatic machines are being constructed which will mould parts from a few centimetres long up to a metre. Blow moulding is much cheaper than other processes, and is now being used also for making plastic parts to replace glass and metal in motor-car accessories.

By a new advance in distribution, a distributor will no longer buy certain spare parts. Instead he will buy stock sizes of tubing and sheet metals together with a 'library' of punched tape. This tape will enable him to transform the stock material into the required finished components. Among the parts already being handled in this way are automobile tail pipes. The result will be a marked diminution in the amount of stock parts a distributor will be called upon to handle and carry.

Then there is the growing development in the use of photography in industrial processes. It is now possible to obtain faster films that enable pictures to be taken in normal conditions of illumination. High speed moving pictures can be taken; and there are available cameras that can take and print a picture in 60 sec, while these same cameras will soon be able to produce and print rapid colour photographs. Television is also being increasingly brought into industry. The writer recently saw the manufacture of tubes in which a television camera enabled an operator to work much more accurately and rapidly and with less effort, by means of a visual screen, showing the progress of an operation.

A process known as explosive forming is rapidly becoming of economic importance. The workpiece is placed on a female die, and an explosive charge is located at a predetermined position above the workpiece and the entire system immersed in a large water tank, so the water acts as the coupling medium between the explosive and the workpiece. It is not a certain cure for all problems of metal forming, and its application is likely to be for areas in which the standard processes are either uneconomical or incapable of meeting requirements. In some instances it has been found that the apparent ductility under explosive forming exceeds the normal ductility.

The introduction of ceramic tools is regarded with mixed feelings in this country. It is, however, true that they have certain advantages over tungsten carbide. First, they are extremely resistant to oxidation, even at high temperatures, but because they are brittle at the cutting edges and cannot be used on interrupted cuts, they are mainly restricted at present to turning operations only.

Chemical milling is itself a novel development in which a piece of metal is formed by dissolving off excess material in an appropriate solution, while protecting the remaining surfaces with an effective mask. At first this process was used only on parts of aluminium, but now steel and other alloys are being chemically milled.

Then there is ultrasonic machining, in which abrasive grains are the cutting edges of the tool. They are carried in a liquid that flows between the workpiece and the tool, and is recirculated for continued use. The same types of grit and the same grit sizes as are used in grinding wheels are employed in this type of machining. The extremely fast motion of the tool face produces cavitation of the abrasive liquid carrier, driving the abrasive grains against the workpiece for the cutting of material.

The very latest means of removing metal is the employment of the electron beam as a cutting agent. An extremely

high voltage electron beam, similar to an X-ray beam, is focussed on the part to be machined by a magnetic field to an extremely fine beam. The beam, in effect, produces a series of fine holes which trace out the shape of the piece of metal to be removed.

High speed machining must also be mentioned. In this, ultra-high machining speeds ranging from 15,000 to 180,000 surface feet per minute are used. The workpiece is a $\frac{3}{8}$ in. dia slug ejected from a 30 to 36 calibre Mauser rifle with a 28 in. long special smooth-bore barrel. A tool is fastened to the end of the barrel, and the slug (267 grain) is fired across the fixed tool bit. By placing the tool vertically, various depths of cut can be taken. By varying the powders, velocities can be varied within the range mentioned.

Cold extrusion is already being used, and begins as a slug sheared from a coil or bar of stock steel. This slug is then deburred, upset or coined, heat-treated, lubricated, and finally extruded. The cold extrusion may be backward, forward or a combination of both processes. Punch speeds range from 7 to 20 in. per second. The process is extremely economical for automation and has the advantage of using standard coil stock, and the chipless forming of the metal into a product. Parts such as bearing races have been produced at the rate of 5600 per hour.

Foundries producing high quality castings to exacting specifications and the best possible properties are becoming interested in a new metallurgical development—the use of vibration. Vibrations applied to molten and solidifying metals are said to be beneficial because they promote degassing, grain refinement and an improvement in the detail of castings because of an increase in apparent fluidity. The most beneficial results are obtained when the metal solidifies as a simple solid solution or pure metal. Further work in this field is continuing. The process is being applied to aluminium, copper and steel alloys, but shows no advantage over other degassing processes except as regards as-cast grain size, which can be appreciably refined, and mechanical properties, which can be improved. Leaded yellow brass is, however, considerably improved.

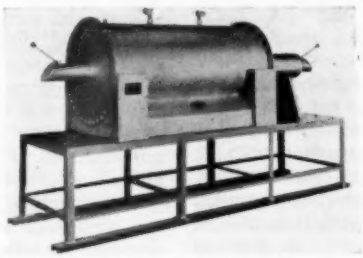
Sintering Furnace

A new heavy duty sintering furnace for operation at temperatures up to 1650°C. with a hydrogen atmosphere has been designed and manufactured by Royce Electric Furnaces Limited, Sir Richards Bridge, Walton-on-Thames, Surrey, for a special application.

The heating chamber is a replaceable tube of fused alumina 5 in. inside diameter, 32 in. heated length. Fused alumina tiles housing the heavy section molybdenum heating elements surround the tube along the heated length and also support the tube, allowing free dissipation of heat and providing mechanical strength. A special high temperature insulation of porous alumina behind the bricks is backed by graded thermal insulation reducing heat losses.

The cylindrical furnace casing is of heavy gauge mild steel plate, with removable end covers, the whole being gas-tight. At the charging end, an extended solid drawn tube acts as a preheat-purging chamber; the exit chamber is water-cooled to ensure that a charge is below oxidation temperature before leaving the furnace.

Atmosphere of hydrogen or cracked ammonia is fed through an inlet under the furnace to distribution pipes in the thermal insulation in the base. The gas percolates through the insulation absorbing heat and is, therefore, preheated before entering the work tube. Auxiliary inlets are provided in the main furnace casing and between heating and cooling chambers to allow an increase in the gas flow when doors are opened for charging or discharging. A 'burn-off' at both doors consumes excess hydrogen and prevents ingress of oxygen.



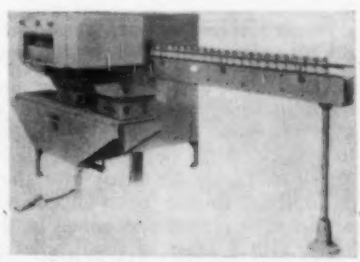
Royce heavy duty sintering furnace

Heating is divided into two independent, automatically controlled zones along the length of the heating chamber. Automatic temperature control, mounted in a separate control desk, comprises three position, indicating type temperature controllers operating motorized voltage regulators giving stepless variation of the low voltage element supply. By this means the current is not switched off when controlling at the pre-set temperature. The secondary voltage of the motorized regulator is automatically adjusted so that the power input to the furnace balances the consumption. This method eliminates fluctuations that may be obtained with 'on-off' control. Similar units are in operation with transductor control. Provision is included for hand control when required. The furnace is rated at 25 kW.

A charge of piece parts in alumina powder in a carbon boat 12 in. long, has a gross weight of 14 lb. The boats are progressed through the preheat, heating and cooling chambers by a hand pusher or by a cycle-timed automatic pusher ensuring repeatability of the sintering cycle.

Jar Packer

Following the introduction of their range of Junior semi-automatic packing machines, Adams Powel Equipment Limited, of Gateshead, announce a new Junior jar packer. This machine, electro-pneumatically operated, enables one operator to pack up to ten cases a minute in arrangements of 4×3, 5×4, or 6×4. The machine will pack into cases with or without divisions and the type of jar or bottle closure does not affect the working. Receiving the filled and labelled bottles or jars in a single line, from one or more filling lines, the packer feeds them forward to the loading head by means of a pneumatically operated pusher mechanism. When the complete load is ready, an indicator light comes on, the operator places an empty case on the loading table and presses the pedal control. The load of jars is neatly discharged into the case and the complete container is automatically lowered to the roller conveyor. The machine cannot operate until a complete load is assembled in the loading head. The operating pressure required is 60 lb psi.



Adams Powel electro-pneumatic jar packer

Pitot Tube Design

A simple device for measuring fluid velocities, the pitot tube operates on velocity head and is largely non-critical in design and application. It may also accommodate up to 40° yaw without adversely affecting readings. Basic design features are discussed

THE pitot tube is essentially a velocity measuring device, inserted in a fluid stream with its opening or orifice facing upstream. Velocity measurement is accomplished by determining the difference in pressure between the inside of the tube and the static pressure outside the tube. The simplest form is a single tube facing upstream although where the differential pressure resulting is too small to operate a suitable measuring or registering device a double tipped pitot may be employed with diametrically opposed orifices, one facing upstream and one downstream. Alternatively the differential pressure may be increased by the use of a small venturi at the tip.

Basis of operation of the pitot tube is a pressure head established by a velocity head and thus the differential pressure available for measurement is entirely due to velocity and not the geometric characteristics of the device (as is the case with orifice plates and venturis, for example). That proportion of the fluid stream trapped by the pitot is brought to rest in the tube and converted into a pressure head. In the simple case of a tube inserted vertically into a fluid stream—Fig. 1—equilibrium is established by

velocity head = pressure head
or $V^2/2g = P/\triangle$
where V = velocity of stream
P = increase in pressure
$\triangle$ = fluid density

The pressure head ($P/\triangle$) is obviously capable of direct measurement and from this the velocity V can be assessed, the head or pressure reading being calibrated directly in velocity units.

The design of the pitot is concerned principally in ensuring that all the velocity head is converted into

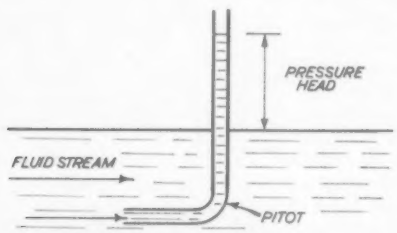


Fig. 1.—The pitot tube in elementary form

pressure head, although in some units a conversion of less than unity may be accepted and the instrument calibrated with reference to an empirical coefficient. An original form developed for aircraft use embodied two tubes facing forwards into the airstream—Fig. 2. In addition to the open-ended pitot tube a second parallel tube closed and coned at the forward end and drilled with a series of small holes provides a practical measurement of static pressure of the stream. Its operation depends on the fact that the streamlined entry produces a smooth airflow over the static tube so that the flow passes the holes at right angles. Thus pressure in the static tube is substantially that of the air itself, irrespective of the velocity involved.

The more modern designs incorporate the pitot and static tubes in a single assembly—see Fig. 3. The central pitot tube is surrounded by the static tube, the latter again pierced with circumferential holes and the annular space between the two tubes connected to the 'static' side of the measuring device. The same consideration holds good that the measured static pressure is substantially independent of velocity, up to critical values. It is also a useful characteristic of a well designed pitot head that the velocity head is independent of small angles of yaw and that exact alignment upstream is not essential. This is particularly useful in the case of aircraft where the pitot is rigidly attached to some part of the structure and thus changes its attitude relative to the airstream with different trimming angles of the aircraft. In industrial applications it is obviously just as easy to align the tube correctly as incorrectly but the lack of sensitivity to yaw merely means that alignment is not critical, although the position of the pitot in the stream may be (see later).

In the double-tipped pitot—see Fig. 4—the tube is located normal to the stream and sealed at the end. It is divided down its length into two equal sections and pierced near the tip with two diametrically opposed holes, one opening into each chamber. One hole faces

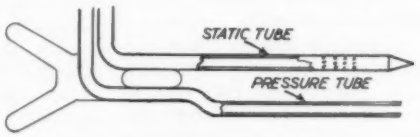


Fig. 2.—Old-type aircraft pitot-static head

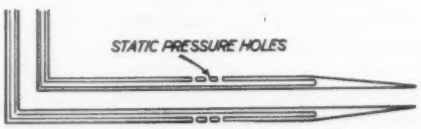


Fig. 3.—Modern type combined pitot and static tubes

upstream and one downstream. There is no static pressure connexion and the two pressure heads extracted from the respective chambers are the normal velocity head conversion and a suction head.

The result is an appreciably larger differential pressure. The suction head will be lower than the velocity-pressure head. Likewise the conversion of velocity into pressure head will normally be less than unity. Thus the differential pressure will be less than twice the differential obtained

with a normal pitot and the instrument is calibrated on empirical lines, utilizing a practical coefficient.

Measuring elements associated with pitot heads are various. The aneriod-type capsule consisting of a pressure chamber with a flexible diaphragm or, more generally, a pressure tight casing with a flexible membrane or bellows offers a compact, simple solution, the membrane movement being spring controlled. Main limitation is the very small membrane displacement realized, coupled with the fact that the effect of the spring rate cannot entirely be eliminated. Linkage to the final indicating or

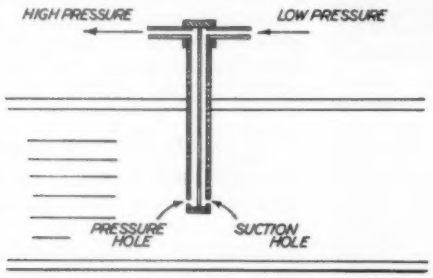


Fig. 4.—Double tipped pitot gives larger differential

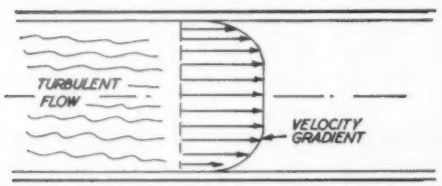


Fig. 5.—Velocity gradient in closed conduits can be traced with the pitot head

recording arm is mechanical, e.g. via link levers or a torque tube.

Industrially, where the call may be for measuring relatively low velocities, and thus small pressure differentials, manometers offer the simplest solution, although not suitable for linkage to dial indicators. Indicators of the latter type employing liquid sealing between the high and low (or static) pressure feeds are usually based on the U-tube. For extremely low pressure gas flows the bell type indicator or ring balance indicator are generally preferred. Both are capable of generating a high output force at very low differential pressures.

Since velocity head—and thus pressure differential—is proportional to the square of the velocity, the final scale advances as a square root progression, leading to a widening of intervals at the higher readings. This is not normally a limitation and is generally accepted. However, modification of liquid seal type instruments is possible to give a substantially linear, if not exactly linear scale. The bell type instrument seems preferred in such cases, e.g. for integration of velocity of flow and time to arrive at flow rates.

A variety of other corrections may be concerned with flow conditions. In a free stream compressibility effects may be present at high velocities. In air, correction is necessary for velocities exceeding about 200 mph, when a formula of the following form is commonly adopted—

Pressure differential $= 0{\cdot}0125\ V^2\ (1+0{\cdot}43V^2\times 10^{-6})$ in this instance V being measured in mph.

Corresponding formulæ for other velocity unit can be arrived at by factoring.

Other corrections are necessary to compensate for density changes which in the case of aircraft applications are, of course, major factors. Industrially similar corrections may be called for where there is any appreciable temperature change in the fluid. Original calibration normally refers to the I.C.A.N. standard atmosphere for air instruments, or directly calibrated for specified ambient conditions for other gas flow measurement. Position-error should not be a problem provided the pitot opening is facing the stream free from turbulence generated by adjacent bodies so that the steady stream velocity is measured.

Where the fluid stream is enclosed within a pipe or ducting, etc., flow velocities are modified by the proximity of the boundary walls, and also by bends and changes of section. Thus it is first necessary to locate the pitot in a substantially straight section of the piping, with preferable at least 15 diameters of straight pipe upstream and 10 to 15 diameters of straight pipe downstream. The characteristic of the velocity gradient across the section of the pipe then depends on whether the flow is laminar or turbulent.

With purely laminar flow, and smooth bore pipes, a mean velocity of one-half of the velocity at the centre is assumed. With turbulent flow the mean velocity is substantially higher—approximately of the order of 0·8 times the velocity at the centre. The mid-section provides a substantially constant velocity—see Fig. 5—so again this is a logical point for placement of the pitot to minimize position-error resulting from any slight difference in position from the true geometric centre (or hydraulic mean centre in the case of non-circular piping or ducting).

The pitot can, of course, itself be used to measure the velocity gradient by traversing the section and noting the pressure head at each diameter station investigated. The velocity gradient is then given by plotting the square root of the pressure head against diameter. Mean velocity can also be established from this curve and related, as a calibration coefficient relative to the ultimate position which the pitot is to occupy. As previously noted, with turbulent flow and the pitot in the centre of the pipe this coefficient will be of the order of 0·8; and for purely laminar flow 0·5.

A general practical formula is:

$$V = K\sqrt{H}/\sqrt{Z}$$

where V = velocity, ft per sec
H = differential head, in. water gauge
Z = density of fluid, lb per cu ft
K = a coefficient = 18·3 .

Synthetic Fibre Conveyor Belting

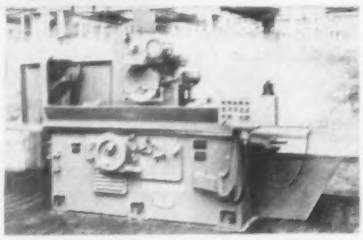
A comprehensive range of man-made fibre belts with safe working stresses ranging from 40 psi per ply up to 200 psi per ply has been introduced by B. T. R. Industries Limited, Herga House, Vincent Square, London SW1. Called NYPAC, the new belts are nylon wefted and combined with either cotton, rayon or Terylene according to the tensile strength required. In addition to the high working stress the new belting offers impact resistance, light weight, flexibility, good troughing, resistance to longitudinal tearing, high pullout strength, and as a result of the flexibility a smaller drum diameter than advocated in B.S.2890 may be used. The belts are particularly suitable where acid or chemical contamination is likely.

The NYPAC range is available in three qualities of rubber cover: 4000 lb, 3500 lb and 2500 lb.

Truforming Grinding Machines

Truforming is an accurate and fast method of producing identical parts by transferring the shape or form of a preformed crushing roll first to the grinding wheel and then to the work. The crushing process produces a very free cutting wheel which gives an exceptionally high rate of stock removal.

The accompanying photograph is of one of the smallest machines in the range, a model BT8-12-36 machine which has a table working surface of 12 in. × 36 in. The 14 in. dia × 2 in. wide grinding wheel is driven by a 5 hp 1500 rpm motor. Maximum height under the grinding wheel is 16 in.



Truforming machine with 12 in. × 36 in. table

In common with all British built Matrix Thompson grinding machines this model incorporates the patented exclusive "Hydra-Cool" hydraulic system which has been developed to eliminate the effects of hydraulic system heat, especially where work must be held to close tolerances during long production runs. By eliminating this heat at its source, the Hydra-Cool system prevents all distortion which would occur in the machine, particularly the harmful distortion of the work table. In the Hydra-Cool system there are no external relief valves and the hydraulic oil supply is automatically regulated to suit the machine requirements. Hydra-Cool never allows more than the required volume or pressure of oil to be pumped and since this compensation is fully automatic no excess energy is ever present in the system to be dissipated as heat.

Infinitely variable table speeds from 3 in. to 75 ft per min are provided, the table traversing on automatically lubricated V and flat-ways which are twice the length of the table work surface, thus providing adequate support even at extreme traverses. Wheel head cross slide ways are flame hardened and ground. A patented anti-friction elevating nut ensures rapid and accurate positioning of the wheel head. A micrometer back-up stop graduated in 0·0001 in. divisions is fitted to the elevating handwheel.

A slow speed wheel spindle drive unit is incorporated in the wheel head for crush forming the wheel which is carried out with automatic timed downfeed. A crushing roll fixture is fitted at each end of the table, one being equipped with power drive.

For initial crushing and for subsequent recrushing when production grinding, the wheel is fed down, under timed automatic control, into contact with the work roll in the right hand fixture. For this operation the work roll idles. When the work roll loses its form after a number of crushing operations, the wheel is crushed by the master roll mounted at the other end of the table. The work roll is then reground with the grinding wheel running at normal speed and the work roll power driven. This reprocessing is carried out without disturbing the work set-up. As both the master and work rolls are in precise alignment the latter is restored to its original accuracy. Crushing rolls can be supplied to suit customer's requirements and various auxiliary equipment is available for these machines, including automatic cycling feeds, circular form attachments, rolled thread die fixtures, D.C. wheel spindle brake, etc.

Designed and developed by The Thompson Grinder Company, Springfield, Ohio, U.S.A., Matrix Thompson Truforming grinding machines are now manufactured under licence in this country by Coventry Gauge & Tool Company Limited, Sole selling agents in the U.K. are Rockwell Machine Tool Company Limited, Welsh Harp, Edgware Road, London NW2.

Precision Bandsawing and Bandfiling

Gebr. Thiel, Western Germany, for whom sole selling agents in the United Kingdom are Rockwell Machine Tool Company Limited, Welsh Harp, Edgware Road, London NW2, have recently introduced a new precision bandsawing and bandfiling machine. This new design is based on over 50 years experience in this field and is the first genuine Thiel designed and built bandsaw available in this country since 1939.

New Thiel bandsaw with three guide wheels

Three saw guide wheels mounted on shielded ball bearings are used, allowing a deep throat of 19⅝ in. The front upper wheel is mounted on a block which is adjustable in its guideways by an external handwheel for correct tensioning. Large hinged doors provide access to the saw wheels and allow quick saw changing.

The machine is powered by a 1½ hp motor mounted in the base and controlled by a foot operator switch. Drive is by a variable speed unit providing saw speeds infinitely variable from 50 to 3000 fpm. Speed is changed by the handwheel at the left of the base, the adjacent dial indicating the set speed.

The 24 in. × 24 in. table is mounted on a robust trunnion bracket which allows table swivel up to 30° to right and left and up to 15° to front and back. Swivelling movements are by rack and pinion, graduated scales indicating the angle of inclination. The upper and lower precision saw guides are adjustable for height, the maximum thickness of work admitted being 9¾ in. A magnifying glass and low voltage work light, both on adjustable

mountings, are included in the standard equipment, and an air pump and piping for swarf dispersal. A chute within the machine frame delivers swarf to the front of the base.

A bandsaw butt welding and annealing unit is housed beneath the upper hinged door. This unit includes a grinding wheel and guillotine. The drive sprockets and special guides for bandfiling are easily and quickly fitted. It is unnecessary to remove the bandfile drive sprockets when using the machine for bandsawing.

Grinding Brake Discs and Clutch Plates

Brake discs, clutch plates and similar circular components produced in large quantities demand the speed and accuracy of the duplex process for grinding in a single operation two opposing flat faces, coupled with the characteristic peripheral grinding pattern which for this type of work is preferred to that produced by orthodox duplex face grinding machines.

The new Wickman-Scrivener 36 DPG machine, developed by Arthur Scrivener Limited particularly for disc brake work, is based on the Scrivener 36 in. Duplex face grinding machine but has its spindles arranged at right-angles to the direction of wheelhead infeed, so that the peripheries of the two 36 in. dia wheels are applied simultaneously to the parallel faces of the work.

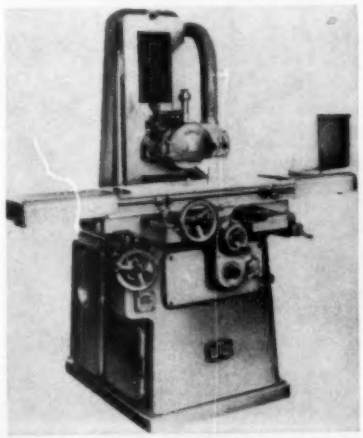
Automatic Scrivener grinder specially arranged for disc brake work

Machine features include automatically oscillating grinding wheel spindles to promote a good work finish, and independent hydraulic power-truing slides behind each grinding wheel. The latter are arranged for manual initiation on the machine from a convenient centralized control at which the direction of diamond traverse and steplessly variable rate of traverse for both wheels are readily selected.

Optionally available extras include automatic work loading and unloading equipment in conjunction with a storage magazine; automatic post-process work gauging with either size indication or fully automatic feedback microsizing; automatic wheel dressing; and coolant filtration equipment.—Wickman Limited, Fletchamstead Highway, Coventry.

Hydraulic Surface Grinder

In the Mikromat hydraulic surface grinder the well-supported and generously proportioned table has hydraulic traverse giving infinite speed variations up to 60 fpm. To ensure maximum accuracy and the finest possible work finish, plain spindle bearings of special design are employed and the spindle head has exceptionally long and rigid bearing surfaces. Dust exclusion has received special attention.

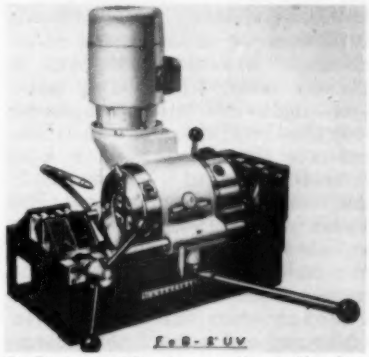


Mikromat surface grinding machine, model SFW 200 × 600

Controls are centralized and easy to operate. Both longitudinal and cross movements of the table are automatic or hand operated, as desired. Limit switches can be set to give reversal at any point. Vertical movement of the grinding head is by hand. A special feature is the extremely fine cross feed (1 graduation = 0·0002 in.).—William Watts Limited, Canal Street, Nottingham.

Thread Cutting

The Fransson and Brantemo range of thread cutting machines comprise three different models for bench or pedestal mounting and made in cast iron or light alloy. They are the Type 2 in. U.V. which has a two-speed motor giving speeds of 17 and 34 rpm to the diehead (optional speeds 29 and 58 rpm), and the Type 2 in. M.V. which has a single speed motor giving speeds through a gearbox of 14 and 24 rpm (optional two-speed motor for 14, 22, 29 and 45 rpm). Both machines have a capacity from $\frac{1}{4}$ in. to 2 in. pipes, $\frac{3}{8}$ in. to $1\frac{1}{4}$ in. bolts, and 12 to 52 mm threads. The third machine is the Type 4 in. M.V. which has a two-speed motor giving speeds through gearbox of 14, 22, 29 and 44 rpm. It will take 4 in. tubes, 2 in. bolts, and cut 52 mm threads.



The Fransson and Brantemo screwing machines have hollow spindles and pipe cutter

All these machines have hollow spindles permitting unlimited length of thread cutting. Self-opening diehead for tangential chasers in Whitworth, B.S.P., B.S.F. and U.N.F. threads, etc., a built in coolant system, a pipe cutter as standard which cuts pipes to any desired length after thread cutting. This last is an exclusive feature which allows tubes, after threading to be released from the vice, passed through the spindle and held in a chuck at the rear of the headstock which then rotates the pipe. The pipe is supported on two rollers, whilst a third, cutting roller is operated by handwheel to cut the pipe to length.

A special fixture is available for facilitating the grinding of chasers in their own holders on an ordinary surface grinder.—Newage Machine Tools Limited, 98–100 Croydon Road, London SE20.

Automation Aids

A new low-priced tape-controlled electronic positioning system, which has a nominal electrical accuracy of one part in 400,000 was shown for the first time at the International Machine Tool Exhibition. Known as the Emicon-400

positioning system, it positions heavy workpieces on medium and large machines, and does not need a specially designed positioning table. Speeds up to 300 in. per min can be controlled by the system, which measures the rotation of a lead screw or pinion, so is readily adaptable to many existing machines. The system is, therefore, suitable for such applications as the drilling of girders and boiler plates, and for use in sawmills. The datum point can be located anywhere in the travel of the workpiece, and a more comprehensive range of instructions than usual can be programmed on the tape.

Another automation aid to be demonstrated for the first time, was the company's new large dynamic balancing machine, which checks the degree of unbalance in high-speed turbines, large armatures and other rotors, up to 250 lb weight. The use of a new type transducer and a new technique in cradle suspension enables a bearing displacement of 8 micro-inches to be readily detected.

Among other exhibits was a display of rotary and linear Emicon inductor micro-positioning devices for machine tool control, and samples of workpieces in two and three dimensions. Also a two-dimensional control cabinet and the latest type of Creed teleprinter.

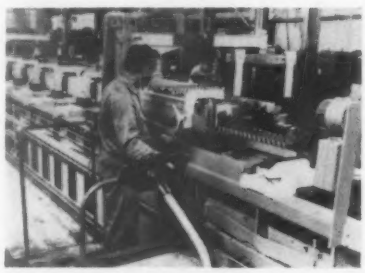
Several of the leading machine tool manufacturers were showing machines fitted with E.M.I. control equipment, and some were also using E.M.I. closed-circuit television systems to enable visitors to observe the accuracy of their positioning tables through auto-collimators.

Broaching Helicopter Blades

The Lapointe Machine Tool Company of Hudson, Massachusetts, U.S.A., whose associate company in this country is at Watford, Herts, have developed a new type of broaching machine on the "building block" or unit construction principle which enables the machine to be lengthened at any time to accommodate longer work pieces if required. An interesting example is a 64 ft horizontal machine for broaching the blades for large helicopters from long, hollow extrusions. The inside contours are first broached and the exterior is then milled to give the required shape. Approximately 600 lb of metal is removed from a 700 lb extrusion before the spar is completed. About $\frac{1}{8}$ in. of stock is removed. The design calls for a 30 micro-inch finish and straightness must be held within $\pm 0{\cdot}005$ in.

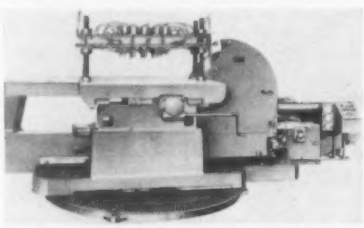
Basically the machine is a horizontal pull broach with a 340 in. stroke, powered by a 50 hp electro-mechanical drive which provides a steady pull on the draw bar during broaching and also returns the draw bar to the initial position after each broaching pass. The machine will broach at speeds up to 80 ft per min.

Eight clamps hold the spar in position. Because of the length and the large amount of stock to be removed, over 30 separate passes are made to complete each part and each pass is made with a separate broach. Cutters are made of high-speed steel, designed as inserts and mechanically fastened into toolholders. These inserts allow much lower tool costs than would be possible with solid high-speed steel cutters, since the holders can be made of relatively low-cost alloy steel.

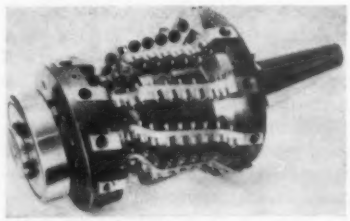


Exit end of broaching machine showing No. 1 broach

Broaches are stored on a conveyor that carries them from one end of the machine to the other, and tool changes are facilitated by two hoists. A hoist at the front end of the machine lifts a tool from the end of the conveyor and swings it into position in front of the draw bar. A hoist at the other end of the spar removes each broach after completion of the pass and deposits it on the conveyor.



COLD SAWING.—This No. 6 horizontal type 'hydrofeed' cold sawing machine cuts R.S.J. up to 36 in. × 14½ in. with a 48 in. dia blade or 36 in. × 12 in. with a 42 in. blade, and can also make cuts at an angle along the major axis. All controls are centralized to ensure the operator has a clear view of the cut.—S. Russell & Sons Limited, Bath Lane, Leicester



WHEEL TRUING CUTTER.—A special cutter head for the Atlas wheel truing lathe. Of the inserted cutter type, it was developed by Firth Brown Tools Limited, Sheffield 4

Rigidhobbers

The MK IV Rigidhobber is a standard machine, made by Churchill Gear Machines Limited, 1323 Coventry Road, South Yardley, Birmingham, in the design of which electrical and hydraulic features have been incorporated to facilitate the application of semi and fully automatic loading systems. It is fitted with a standard C.G.M. transfer arm and a continuous rotary chain type conveyor.

The transfer arm is designed to follow as closely as possible the movements an operator makes when loading manually, so as to make possible the fully automatic operation of the Rigidhobber, singly or in tandem on almost any type of gear. The arm is designed to grip the component, lift it from the conveyor or loading platform, swing into position above the workholding fixture, lower the component on to the fixture, and release. These movements, when controlled in sequence with the machine and conveyor cycles, permit the loading of almost all types of gears and shafts, with one type of standard transfer arm. It is necessary only to change the grippers to accommodate varying diameters.

The conveyor is of the continuous chain type, mounted on a horizontal guide plate. Straight bars attached to the links at intervals provide pockets in which the gear blanks are carried, and the chain is indexed by means of a hydraulic cylinder, also mounted on the conveyor baseplate In operation the blanks are placed manually in the pockets on the outer run of the conveyor, and indexed round to the pick-up point. After cutting, the gears are returned to the conveyor, and indexed into an off-load chute.

Automatic Gear Tooth Checking

The Matrix automatic gear tooth spacing and concentricity checking machine enables exact measurements of these elements to be recorded in a fraction of the time previously required for test. The design is based on an experimental machine developed by the Mechanical Engineering Research Laboratory and incorporates all the improvements indicated during its experimental use.

The machine is automatic in operation and after being set up will completely check a gear for spacing or for pitch circle concentricity, record the results on a graph and automatically stop itself after indexing through the required number of teeth.

The cycle time for a tooth measurement varies from 12 to 20 sec according to the size of the gear being measured and any gear from six teeth upwards can be checked up to a maximum diameter of 12 in.

Gears on mandrels or shafts up to 24 in. long can be mounted between centre. It is, however, recommended that when possible gears should be mounted directly on to the face plate of the work spindle, to eliminate possible errors which may arise from the use of mandrels.

The face plate has a sensitive fine adjustment so that the gear can be set to run dead true with the axis of the main spindle, the same adjustment enabling the main spindle centre to be set dead true when the centre is to be used. Means are also provided for adjusting and checking that the tailstock is co-axial with the main spindle.

The main spindle is indexed by a sine arm which operates between stops and which is set for the required spacing angle by means of slip gauges. All motions of the automatic indexing are carried out pneumatically with special damping means to ensure accuracy of repetition and interlocks are provided to make sure that the machine cannot be automatically operated until all controls are correctly set.—Coventry Gauge & Tool Company Limited, Coventry.

Matrix automatic gear tooth spacing and concentricity checking machine

Precision Cylindrical Grinding

Designed and built by the Coventry Gauge & Tool Company Limited, the Matrix 1A-8-24 precision cylindrical grinding machine is now available with a self-contained motorized workhead for live and dead centre work. Sole selling agents. in the U.K. are Rockwell Machine Tool Company Limited, Welsh Harp, Edgeware Road, London NW2.

Designed for toolroom and high-grade production work, this machine has a maximum capacity between centres of 24 in. with a maximum swing over the table of 8½ in. The new workhead is driven by a ⅓ hp motor and incorporates a gearbox providing six spindle speeds 60–600 rpm. The spindle is mounted in precision taper roller bearings and has a threaded nose for chucks, faceplates, etc. A draw-in collet attachment with a maximum collet capacity of ⅝ in. dia is available. The workhead can be swivelled to any angle, the base being accurately graduated in degrees. The tailstock casting houses a spring loaded barrel provided with adjustment for centre pressure. The dressing diamond holder is mounted above the centre enabling the wheel to be dressed without disturbing the workpiece.

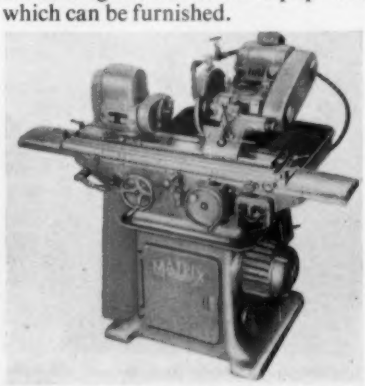
The table which traverses on V and flat way, roller lubricated from pocket reservoirs, is driven by a 1 hp motor. Twenty-four table speeds 4–120 in./min are provided For taper work the upper table swivels up to 20° included angle with fine adjustment by micrometer screw. A scale indicating taper per foot is also fitted. A special stop and dial indicator are available for accurate shoulder work.

The wheelhead is powered by a 1½ hp motor, the drive to the spindle being by V-belts. Three spindle speeds are available through interchangeable pulleys. The spindle runs in adjustable plain bearings and a 12 in. dia × 1 in. wide wheel is fitted as standard. Maximum peripheral speed is 6000 ft/min. Wheel infeed is by a precision leadscrew and nut operated by a conveniently mounted handwheel fitted with a large diameter calibrated dial. Fine increments of infeed are applied by depressing a lever which turns the leadscrew through a ratchet and pawl mechanism. An adjustable step is provided which can be set at size for production work. Machines can be supplied fitted with a universal wheelhead with a compound swivel and independent top slide movement. This enables the wheel to be fed into the work at any angle to the table axis. The wheel can be rapidly advanced or withdrawn by a quick action lever. An adjustable stop ensures accurate repeating. This wheelhead can accommodate grinding wheels at either end of the spindle, the motor being spigot mounted to facilitate changing the drive.

An internal grinding attachment is available and this is mounted on an accurately machine locating face on the wheelhead casting. Spindle speed is 22,000 rpm.

The electrical switchgear is totally enclosed but easily accessible, being mounted on a hinged panel at the rear of the machine. The coolant tank and pumps is a separate unit, the tank being mounted on castors for easy withdrawal for servicing and cleaning.

Chucks, faceplates, two and three point steadies, profile wheel dresser are among the additional equipment which can be furnished.



New Matrix 1A-8-24 precision cylindrical grinding machine

New Methods of Generating Electric Power

Magnetohydrodynamic Generators

By Dr. STEWART WAY

ABOUT 130 years ago, Michael Faraday discovered that a conductor moving in a magnetic field could be made to generate an electric current. This principle has traditionally been applied to produce electric power by mechanically rotating solid copper bars past energized field windings. However, Faraday's experiments showed that power can also be generated by substituting a flowing liquid metal such as mercury, or some other conducting liquid, for the copper bars. A device that uses a fluid conductor to produce an electric current is a magnetohydrodynamic generator.

The word magnetohydrodynamics, abbreviated MHD, stands for the branch of physics that encompasses both electromagnetic and fluid-dynamic phenomena. Practical realization of MHD power generation appears at the present time to depend on the use of a conducting gas. For the gas to be conducting, a certain number of free electrons must be present, along with an equal number of ions, plus the main body of un-ionized gas. The most direct approach to partially ionize a gas, and thereby make it conducting, is to heat it sufficiently. However, the temperatures involved are beyond the limits of even the most modern of materials.

When the gas is "seeded" with a certain concentration of an element such as potassium or caesium, adequate electrical conductivity can be realized at somewhat lower temperatures in the range of 4000° to 5000° F. The possibility of MHD generation, as currently conceived, hinges on the small region of overlap between the temperatures that a few materials are able to tolerate, and the temperatures which are necessary, even with seeding, to obtain adequate conductivity.

In an MHD generator, hot ionized gas travels through a magnetic field which is applied at right angles to the flow, and past electrodes which are in contact with the stream of gas. Electrons in the gas are deflected by the field and, between collisions with other particles in the gas, they make their way diagonally to one of the electrodes. An electric current is produced as the electrons move from the anode, through the load, to the cathode, and back again to the gas stream. (See Fig. 10.)

It has been announced recently by Dr. S. N. Herwald, Vice-President—Research, Westinghouse Electric Corporation, that four new methods of generating electric power have been developed to the state where they appear to hold real promise as power sources for the future. This work is being pursued in new laboratories which John K. Hodnetle, Executive Vice-President, says doubles the company's research facilities. Dr. J. A. Hutcheson, Vice-President—Engineering, summarizes the four new methods as the fuel cell, the thermoelectric generator, the thermionic generator, and the magnetohydrodynamic generator. These operate at successively higher temperatures and raise entirely new problems in materials. The possible rewards are great however—high efficiency, low capital costs, and new possibilities in power generation, storage and use. In these articles members of the Westinghouse research team explain the preliminary stages of the work.

The voltage at the terminals of an MHD generator is directly proportional to the intensity of the magnetic field, the velocity of gas, and the distance between the electrodes. A generator will supply maximum power when the load connected to its terminals has a voltage drop equal to one-half of the circuit voltage.

Near peak power, the efficiency of an MHD generator may be as low as 50%, because of I^2R losses. But efficiencies in the 80% to 90% range are possible when the generator is operated somewhat below maximum power. This corresponds to the efficiency of a conventional steam turbine-generator combination, which is about 80%.

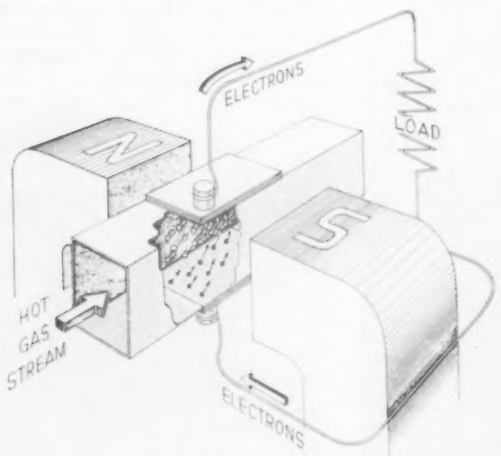


Fig. 10.—Simplified diagram of the operation of a magnetohydrodynamic generator

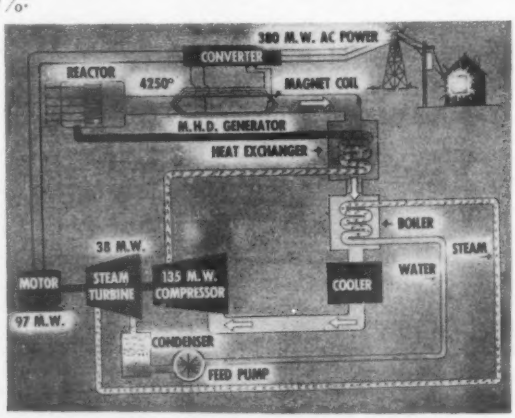


Fig. 11.—A proposed 380 MW central station plant using an MHD generator as the power source

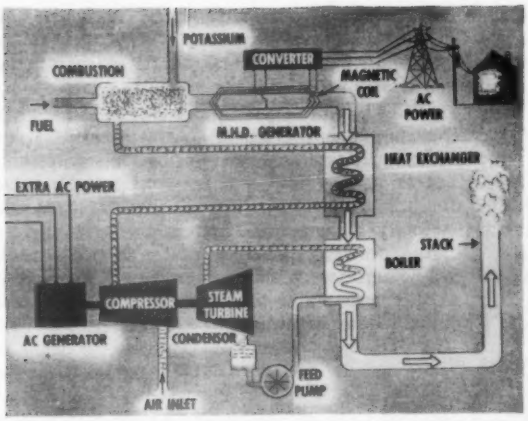


Fig. 12.—Magnetohydrodynamic open system using fossil fuels. Combustion products replace helium-caesium mixtures in conventional units

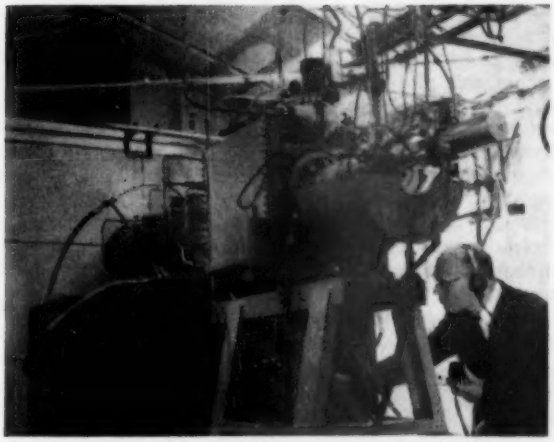


Fig. 13.—This magnetohydrodynamic power generator is the first to operate in the kilowatt range for a sustained period (four minutes). It is also the first sizable MHD unit to burn natural fuels in producing electricity. Hot ionized gas from an oil-oxygen flame is sped through a magnetic field at velocities as high as 1800 mph. The unit has already been tested at 2½ kW and is designed to produce about 10 kW

The over-all thermal efficiency of a plant utilizing an MHD generator might be as much as 60%, as compared with 40% to 42% for the most modern conventional power plants. The high efficiency of the MHD plant arises principally from the high temperature which is necessary for ionization.

A possible cycle arrangement is shown in Fig. 11. This is a "closed cycle" system in which a gas consisting of helium seeded with 1% caesium is used. The plant portrayed would generate 380 MW of a.c. power. Note that the MHD generator puts out direct current, and that a converter is used to produce alternating current. The capital cost of this converter would be appreciable, though not prohibitive. Studies are being made for the direct MHD generation of alternating current power. There are several approaches to this problem that look promising.

The MHD generator for this system would be 30 to 40 ft long, and it would operate in the temperature range of 4000° F. A reactor is shown as the heating device, but the development of such a reactor would take many years. The heat exchanger, or regenerator, would also present serious development problems.

Fig. 11 also shows a boiler in which some heat is picked up and used to generate steam. This steam drives a 38 MW turbine, which powers the gas compressor. In this it must be assisted by a motor which consumes some of the MHD generator output.

To circumvent reactor development problems, there are two possible lines of attack: (1) use a combustion fired external heater, while retaining the closed loop helium system of Fig. 11; (2) use an open system in which the combustion gases pass directly through the generator. The latter arrangement is pictured in Fig. 12. In this case, it is possible to generate a surplus of power in the steam loop so that an extra generator is present, replacing the d.c. motor of Fig. 11. Temperatures of operation in the generator must now be higher, however, because of lower mobility of electrons in combustion-product gases than in helium. Another difference is that potassium rather than caesium is used for seeding since caesium is too costly to discharge. Means would, in any case, have to be taken to avoid air pollution by the hydroxides of these elements.

Problems ahead in MHD generation development are in the general areas of physics, materials and engineering technology.

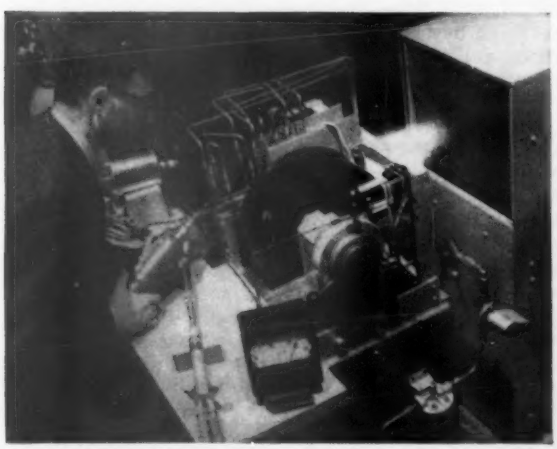


Fig. 14.—Magnetohydrodynamic generator specially constructed for experiments using combustible fuels. The unit blasts a stream of hot ionized gas through a magnetic field at velocities up to 1100 mph. The device produces electric power equivalent to approximately one watt

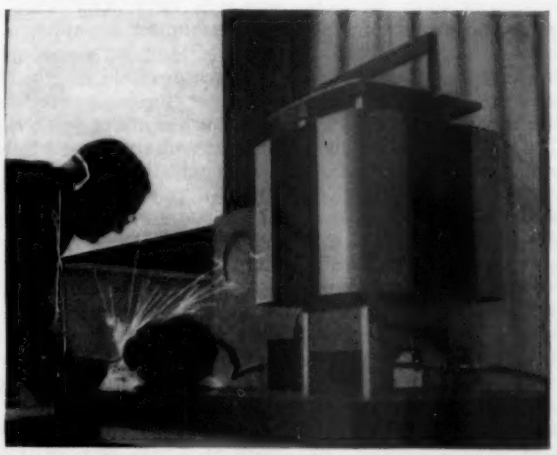


Fig. 15.—Providing a convenient and portable power source, this thermoelectric generator is here seen providing power for a grinding wheel. Capable of producing 100 W, the generator is a convection, air-cooled device using a propane gas as a fuel

Further work needs to be done in laboratories to obtain more reliable data on conduction of electricity in gases, and to provide a better understanding of the basic mechanisms of energy and momentum exchange in the MHD generator. Materials must be developed to better withstand high temperatures, sudden temperature changes, and chemical interaction with the alkali-metal seeding materials. New engineering and design approaches must be found to build durable parts of ceramic, which have conventionally been made of metal. Durable electrodes must be developed to withstand high temperatures and chemical attack, and yet they must be good conductors.

To study these problems, several lines of research are being pursued in Westinghouse. First of all we have the basic studies of materials and their properties, and investigations in gaseous electronics. Secondly, two experimental MHD generators have been built and are in operation. One of these is relatively small, for laboratory type studies; it burns hydrogen and oxygen, seeded with potassium. This generator was designed by physicist Dr. Werner Emmerich. The other generator project involves a machine which has, to date, put out about 2·5 kW at one-fourth maximum power rating for 4 min continuously. It burns furnace oil and oxygen, with potassium soap dissolved in the oil as a seeding element. Oxygen, rather than air, was used merely as a convenience, to avoid the necessity of building a large air preheater.

Although MHD devices for producing short bursts of power have already been demonstrated and may offer potential in specialized applications such as in satellite communications systems, a generator must operate continuously for the practical generation of commercial electric power. To date, the only MHD generator which has been able to produce kilowatts of power over a sustained period of time is this larger machine. Further, it operates on combustion products rather than on argon gas heated by an electric arc. In short, it demonstrates generation of electric power directly from a hot gas stream.

The machine, pictured in Fig. 15 has an electromagnet, mounted on a platform that can be raised or lowered. This magnet produces a field in the generator of 14,000 gauss. The generator section proper has a flow cross section of $1\frac{5}{8}$ in. by $4\frac{7}{8}$ in., and it is 16 in. long. Three pairs of graphite electrodes are mounted on opposite sides of the stream, with a distance of $4\frac{5}{8}$ in. between their faces. The insulating side walls are of $1\frac{1}{4}$ in. thick zirconia. Flow of the combustion gas is 1·1 lb per sec at the design point, and the temperature is about 4600° F. The velocity is roughly 2000 mph, and the pressure is about one atmosphere. Approximately three pounds of oil-soap mixture is burnt with eight pounds of oxygen in a specially designed swirl-type combustion chamber that discharges into a mixing plenum, and then into the generator proper. Water-cooled side walls are used throughout, and zirconia lining is used everywhere except in the combustor flame tube, which is stainless steel. The 2·5 kW of power corresponds to one-half of the design flow rate, or one-fourth of the power.

This model is being used to investigate generator sidewall designs, electrode materials and configurations, power distribution in the generator, chemical reactions with the seeded gas, operating characteristics of the MHD generator and electrode potential drops and potential and temperature distributions.

Before a practical power source using MHD generation can be built, much work remains to be done on the problems mentioned above. The MHD experimental generators will help provide some of the answers.

Some reference has already been made to possible open and closed cycle and indirect heating arrangements; also to direct alternating-current generation. For straight-through MHD generators, various configurations are possible, including constant pressure, constant area and constant velocity designs, or various combinations of these. Other geometries, also, should and will be investigated. The indirect-fired closed-loop system, adapted to direct a.c. generation, would seem to be one of the most promising lines of attack to follow.

Conveyor Scraper

Richard Sutcliffe Limited, of Horbury, Wakefield, have designed a multi-blade scraper for belt conveyors which may readily be fitted to any type of conveyor framework and which reacts quickly to variations in the belt line, and the scraper edge is not subject to excessive wear in the centre where the bulk of abrasive material adheres to the belt.

On the multi-blade device, each blade is mounted on a separate spring steel bar which allows it to wear individually according to the amount of work it does and in this way no part of the belt is left unscraped. Blades are from 5 to 6 in. width and wear-resistant rubber to a height of 2 in. is bonded on to each leading face.

The blade is supported at right-angles to the carrying surface of the belt by a spring steel bar which runs parallel to the centre line of the conveyor and is carried at the opposite end by a cross shaft mounted in brackets on the side frames and carried by a spring-loaded torsion bar. Initial pressure can be applied externally by this torsion bar whilst local pressure is maintained by the spring of the individual bars. Two sets of blades may be ranged across the width of the conveyor by mounting the spring steel bars at a pitch slightly greater than the width of each blade, using alternate bars of different lengths. In this way the belt is virtually scraped twice at each pass.

The rubber scraping edge and the steel blade wear down simultaneously. The scraper is mounted so that the blades trail from the cross shaft and this prevents snagging by fasteners or projecting edges of torn belts. Inner and outer blades are interchangeable and are simple to remove.

New Electrode

New in the Ruby range of Diadem electrodes produced by Cooper & Turner Limited, Vulcan Works, Vulcan Road, Sheffield 9, is the 14 gauge size. The B.S. 1719 coding is E217, it being solid extruded, rutile based and suitable for use in all a.c. welding positions on mild steel, with an open circuit voltage of not less than 45 volts. The easily controlled slag allows either open arc or touch welding techniques with low spatter. Mechanical properties include a yield point of 24–28 ton sq in., ultimate tensile strength 29–34 ton sq in., carbon content 0·08 to 0·10% with maganese between 0·55 and 0·65%. Core diameter is 0·104 in. and the electrode is supplied in 12 in. lengths. Current range is 65 amp minimum to 80 amp maximum, and the deposition rate at 72 amp is 71·7 lb per cwt. of electrode.

Servo Valves

The Keelavite servo valve consists of a rotary torque motor driving a pilot valve, which provides one stage of hydraulic amplification, to control the position of the second stage piston. The first stage consists of a nominally zero lapped 3-way valve, which is driven against springs by a rotary torque motor. Balanced windings of either low or high impedance are fitted to the torque motor. An inductive rotary pick-up, also driven by the torque motor, is used to close a feed-back loop around the pilot valve. The second stage consists of a conventional piston type valve, with a close grain cast iron body, which may be fitted with either a 4-way or 5-way piston. Internal leakage and flow linearity with deflexion are both

Keelavite type 5545 electro-hydraulic servo valve

dependent on piston lap. A torque motor amplifier, two error amplifiers, two phase sensitive rectifiers, and a.c. and d.c. power supplies make up the servo control unit. Carrier frequencies in the range of 400 c/s to Kc/s may be used to energize the pick-offs.

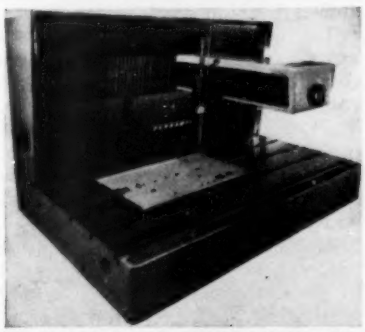
The centre (jack) port of the pilot valve is connected to one end of the second stage piston, whilst full servo pressure is applied to the other end, which is half the area of the first end. Full servo pressure is applied across the pilot valve. Consequently, if the pilot valve is centred, balanced forces are applied to the ends of the second stage piston since under these conditions the pressure at the jack port is half servo pressure, and the second stage piston will remain stationary. A small deflexion of the pilot valve disturbs the force balance, and the velocity of the second stage piston becomes proportional to the deflexion of the pilot stage piston and to the electrical input signal to the torque motor. In order to make the position of the second stage piston proportional to the input signal, a feed back loop is closed around the second stage. An inductive pick-off of the rotary type, driven by a crank actuated by one end of the second stage piston, is used for this purpose.

The valve is made by Keelavite Hydraulics Limited, Allesley, Coventry, and two sizes are currently available: type 5545 giving a flow for a pressure drop of 1000 psi of 25–30 gpm., and type 5572 giving a flow for a pressure drop of 1000 psi at 100 gpm.

Electronic Co-ordinate Inspection

A new co-ordinate inspection machine developed by Ferranti Limited, Hollinwood, Lancs, utilizes transistorized electronic counting circuits and optical measuring gratings to inspect machined parts to an accuracy of 0·001 in. As a result, it can check the proportions of a machined part in half the time taken by more conventional inspection methods such as the use of indicators, engineers' dial gauges, etc.

The operator has under his control an inspection probe with interchangeable tips suitably shaped to locate at any point on a machined



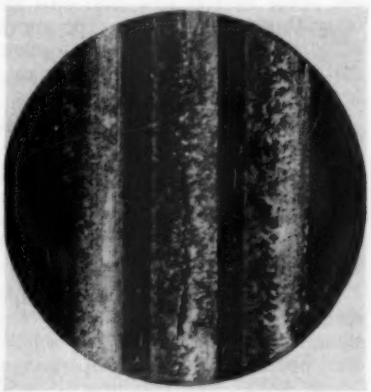
Transistorized electronic counting circuits enables this new Ferranti machine to inspect machined parts to an accuracy of 0·001 in. Optical measuring gratings are used

part. This probe is supported from a rigid cantilever beam projecting over the work table and is free to move over the length and breadth of the table. Movement of optical gratings attached to both longitudinal and transverse axes of the machine create a Moiré fringe pattern that activates photocells. Changes in light intensity are converted into pulses that are stored by transistorized bi-directional decade counters. Measurement information is then displayed continuously on two five-figure groups of easy-to-read numbers. Machines that read in 0·001 in. units have an indicator that reads 'minus' over the first half of each unit step and 'plus' over the second step, providing an accuracy reading down to 0·0005 in.

Welding Electrode for Extreme Conditions

An experiment carried out recently by Rockweld Limited has proved that their Tropicalized Flexend electrode can resist moisture and remain usable after prolonged exposure to abnormal weather conditions.

The experiment was arranged by Rockweld agents in Malaya, this country being chosen because its humid atmosphere provided an



Three electrodes after prolonged exposure to the humid atmosphere of Malaya. The new Tropicalized Flexend electrode was unaffected

excellent testing ground.

With two normal electrodes, a Flexend electrode was left in the open, covered only by a small tin roof. The electrodes were left for six months, and in that time were subjected to a complete cycle of humid conditions.

At the end of this period the two normal electrodes had acquired fungoid growths and extensive cracking had taken place. The Flexend electrode, however, was completely unaffected. It was returned to the Rockweld factory at Croydon, where it was satisfactorily used for welding.

Tropicalized Flexend was produced as a result of intensive research to find an electrode which would be more moisture-resistant than existing electrodes.

In addition, it is an electrode which gives a smooth, non-spatter finish. It may be used in any welding position on plate up to 40 ton tensile strength. It is a solid extruded, down-hand, vertical and overhead electrode. The slag is of the quick-freezing type which leaves a clear welding pool and allows ease of manipulation.

Pressure Reducing Valves

A new range of Pressure Reducing Valves, in sizes from ½ in. to 2 in. is announced by Samuel Birkett Limited, Queen Street Works, Heckmondwike, Yorkshire. The valves (known as Type 470) can be applied to all factory and industrial services—steam, gas, air, or liquids—and are of simple design which enables them to be reasonably priced. The valves are generally constructed of heavy bronze castings, but the wearing parts, in all sizes, are made of stainless steel and an integral strainer prevents the entry of dirt, scale, or other foreign matter which would cause injury to the seating.

Irrespective of flow demand there is only slight downstream pressure variation up to the maximum rated capacity, and a tight closure when there is not demand. The spherical valve is practically self-cleaning and the metal seating is renewable.

The valves are suitable for upstream pressures up to 250 psi for steam, or 300 psi for air or water, and operate at total temperatures up to 450°F. The maximum downstream pressure is 150 psi for the ½ in. and ¾ in. sizes and 125 psi for other sizes. Pressure alterations are made by simple screw adjustment.

Birkett "470" pressure reducing valve

Molycue Greases

The series of Molycue greases manufactured by Rocol Limited, Rocol House, Swillington, near Leeds, are a combination of molybdenum disulphide with polyalkylene glycols with or without the addition of thickeners.

Poly-alkylene glycols are among the most successful of the synthetic lubricants introduced for practical lubrication. They have a special heat resisting quality and, unlike petroleum oils, do not leave a carbonaceous residue when they burn. They have resistances to solvents greatly superior to ordinary lubricants and can often lubricate chemical plants when other lubricants have failed.

But, as with all synthetic lubricants their qualities often require supplementing to meet contemporary requirements. Rocol have produced several combinations of molybdenum disulphides and polyalkylene glycols, which provide balanced lubricants to meet extreme conditions of pressure or to provide longer periods of lubrication than that of the fluid alone.

The combinations also supply a means of conveying molybdenum disulphide to working surfaces in conditions where oil would burn. The working lubricant film of molybdenum disulphide is left on the working surface, uncomplicated by any carbon residue, which occurs with petroleum oils.

Molycue and Molycue-10 are two grades which are highly successful in glass and ceramic working and fabricating machinery, for kiln car axle lubrication, in ovens and driers. They are also useful for lubrication in contact with rubber seals and components in rubber.

Two other Rocol Molycue greases are for general application under normal conditions where rubber or solvents are encountered. These greases are non-melting, because of being thickened with bentonite. Having a 320 penetration, they may be applied by means of grease guns and ordinary nipples or cups.

Rocol Molycue grease U-10 is water insoluble and should be used where wet conditions prevail or polar solvents are present.

Rocol Molycue grease W-10 is water soluble but is exceptionally resistant to petroleum fluids, particularly petrol (gasolene), paraffin (kerosene) and lubricating oils. It is also resistant to fatty oils and can be used in many food manufacturing operations and is, also, generally more resistant to non-polar solvents than the U-10 grade.

Both greases are excellent rubber lubricants and, according to their individual properties, excellent for valves and plant employed in the handling of chemicals and oils. In this way maintenance and operating costs are reduced and safety increased.

Rocol Molycue W-10 is useful also for dry cleaning because its soft nature allows ordinary, standard bearings and lubricators to be used in the plant.

Ruston Hornsby air-cooled diesel driven welder

200 amp Welder

A further addition to the new range of Lincoln Electric Company Limited, engine driven welding generator units is now available from their Welwyn Garden City Works. Known as the SA 200, the new unit is powered by the Ruston Hornsby 2YWA 2 cylinder air-cooled diesel engine developing 21 bhp at 2,000 rpm and incorporates a newly designed generator unit providing 30–275 amp hand welding current or 200 amp continuously. The unit supplies uniform welding current for metallic arc welding with bare or heavily coated electrodes, also for carbon arc welding.

The open circuit voltage can be adjusted in a continuous sequence by means of a shunt field rheostat whilst control of welding current is accomplished by adjustment of both the series and shunt fields. The generator field rheostat and current regulating switch are mounted on a vertical steel control panel, and terminals with wing nuts are provided on this panel to facilitate the easy change of the polarity of the welding current.

An important feature is that the generator is mounted directly on the engine bell housing and is driven by means of a coupling which connects to the flywheel by means of Silentbloc flexible bushes.

The new welder can be supplied with four small or two large diameter running wheels, with screw jacks and jockey wheel for fast road towing.

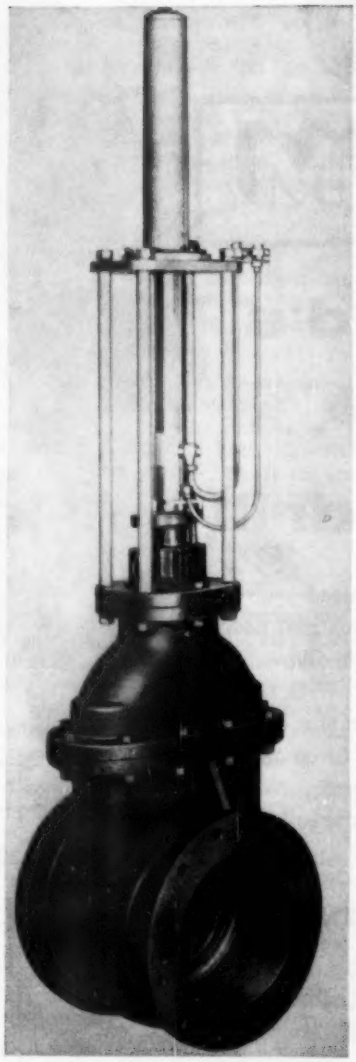
Valve Actuators

A positional actuator which controls the extension of a piston rod within a cylinder, thereby providing positional control of various mechanisms or flow control of valves to limits of accuracy as required in different applications, is made by Hydraulics and Pneumatics Limited, Villiers Street, Wolverhampton. The actual control itself can be mechanical, electric, pneumatic or hydraulic.

One application is to the Blakeborough sluice valve as commonly used in pipeline applications. The flow is controlled by opening or closing a wedge-shaped gate within the valve port. The actuator is mounted on the valve in line with the valve lifting spindle and is supported without modification to the sluice valve. The remote control system is by a pneumatic signal to a pilot cylinder of the actuator, and the system responds effectively at a distance of approximately 200 ft between the sluice valve actuator and the control station.

Another example is a Boving general purpose low head butterfly valve, 36 in. dia, of the type developed for hydro-electric and cooling water circuits in atomic power stations. This valve is controlled by a hydraulic actuator with remote electrical operation, when the solenoid control on the actuator is energized, the large butterfly valve is power positioned to its maximum flow position, and closes immediately the solenoid is de-energized. In the event of electrical failure, the actuator control automatically closes the butterfly valve to provide fail-safe operation. This system can be linked to any remote distance from the control station.

A novel application of the servo actuator for torque control drives is on boiler damper control or similar applications. The actuator serves as a high force level damper positioner responding to instrument air pressure relayed from a controller. A high gain positioner diverts air pressure to one side or the other of an equal area double-acting pilot cylinder, when the control air signal fluctuates from the steady state. When this pressure is as low as 0·1 psi the maximum restoring force is available, and therefore the system is highly accurate. The pressure drop generated across the pilot piston offsets the spool, causing the actuator to progress until such time as the feed-back on to the positioner crank brings about sufficient decay of the air signal to recentralize the spool rocker arm, thus hydraulically locking the actuator. As an installation it is compact, relatively inexpensive and reliable, and is a basic mechanism quite universal in its application potential.



H. & P. hydraulic sluice valve actuator with integral pneumatic pilot valve for remote operation

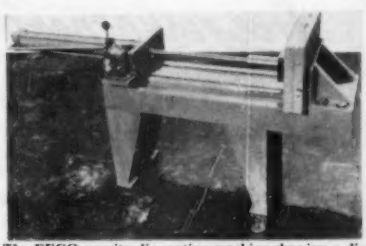
In certain applications for actuators it is not possible to transmit mechanical or pneumatic signals, due to the distance between the actuator and its controls. Electrical signals can be used, but the signal strength must be kept as low as possible to reduce the size of the electrical equipment and provide a sensitive control with negligible backlash. A typical electro-hydraulic servo actuator is by an electrical solenoid, with feed-back to the system transmitted via a potentiometer to the control station.

Gravity Die-casting

A simple die-casting machine which uses inexpensive dies and can be operated without previous die-casting experience has been introduced by the foundry division of Electric Resistance Furnace Company Limited, Netherby, Queens Road, Weybridge, Surrey. It has been designed to reduce both the capital and running costs of producing iron and light metal castings which do not need to be made within close dimensional tolerances.

The machine has a two-way cylinder for closing and clamping the dies and requires only a supply of compressed air for its operation. The die heating and cooling arrangements of conventional die casting machines are not required, the dies are made in a grade of Meehanite metal to withstand thermal shock and the machine is used in banks of sufficient numbers to allow time for natural cooling.

For making iron castings weighing about 3 lb the dies require a cooling time of about 4 min. In this time two operators, one pouring and the other removing the castings, can tend fifteen machines and produce 225 castings an hour. Dies are designed by the company from customers' drawings and supplied ready for insertion into the casting machine. They are made by the 'true to form' as-cast technique at approximately one quarter the cost of machined dies.



The EFCO gravity die-casting machine showing a die closed ready for pouring

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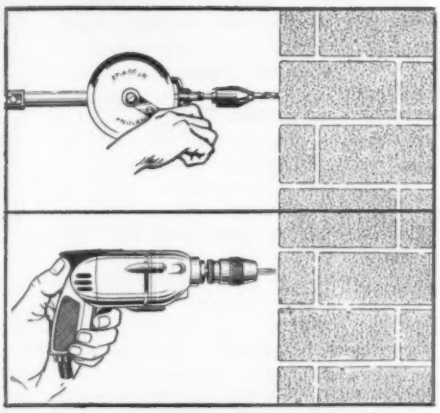

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Machine Drawing and Design. By W. Abbott. London, 1960; Blackie & Son Limited. 21/- net (by post 22/6). 281 pp. 5½ × 8½ in.

This deservedly popular treatise appears now in a seventh and largely rewritten edition. In its new form it encompasses present-day requirements as regards drawing methods and presentation, giving attention to the perspective views now so much used as well as the modern orthographic styles. Many design topics, with appropriate formulae, are introduced into the text such as criteria of failure, materials, and factors making for a satisfactory product and economical production. Many details are treated both as regards their representation and design, such as the various fastenings, shafts and fittings, brakes and clutches, bearings, gearing, valves and engine details, and there are some interesting pages on aircraft components. The use of tolerances on drawings is also dealt with, the principles being clearly stated and recommended practice explained; there are also tabulated data and examples. Additional to the numerous examples in the text are some 40 pages of examples in machine drawing and design to supplement the main text and to illustrate the kind of question likely to be encountered in examinations. Altogether the book provides a good intermediate course. There is a companion volume, also by Mr. Abbott, "The Dimensioning of Engineering Drawings" which deals particularly with the application of tolerances.

Alternating Current Machines. By H. Cotton, M.B.E., D.Sc., M.I.E.E., London, 1960; Cleaver-Hume Press Limited. 21/- net (by post 22/-). 328 pp. 5 × 7½ in.

This concisely written account of the most widely used kinds of electrical machinery will appeal principally to non-specialist students and those in industry requiring a good basic treatment of the subject. As the author has been concerned with presenting a physical concept of the processes involved he has used the minimum of mathematics and anyone with a good introductory knowledge of technical electricity can easily follow the text. The book has proved popular since it was published eight years ago and for this second edition, some revisions and additions have been made. In keeping with modern practice m.k.s. units are now used; extracts are given from British Standard specifications on motor starters and controllers; the construction and characteristics of small a.c. commutator motors and universal motors are described; and guidance is provided on the choice of a suitable motor, taking into account environmental conditions.

Price of Coal.—A fourth edition of "Coal—The Price Structure" has been published by The Federation of British Industries, 21 Tothill Street, London SW1. (Price 2/6). It covers all grades of coal used for industrial purposes throughout the country and in the preparation of this and previous editions the F.B.I. have been guided by the original memorandum of the National Coal Board. The form of the booklet has also been agreed with the N.C.B.

books

British Transport in 1959.—With the purpose of, presumably, making the general public aware of their activities during the past year the British Transport Commission (222 Marylebone Road, London NW1) have issued an attractively produced booklet "British Transport in 1959", costing two shillings, which has some good colour and black and white photographs, very clear diagrams, and a simple, informative text. The story is not altogether a happy one but the compiler has done his best to make the reader not too despondent after reading it.

Rubber.—According to the annual report for 1959 of the Natural Rubber Development Board the production of natural rubber during 1959 showed a slight increase over the previous year's figure. The report surveys the use of rubber in roads, building and engineering, furniture and footwear and lists statistics of the board's activities, accounts and current publications. In July of this year the board was renamed the "Natural Rubber Bureau" and the address is: Market Buildings, Mark Lane, London EC3.

D.S.I.R. Report.—During 1959 over 360 applications for research grants, totalling over £3 million, were received by the Department of Scientific and Industrial Research and 295 of these were awarded totalling over £2¼ million. This information is given in the Department's annual report which shows that in general the year has been an active one of steady expansion and consolidation. The report is published by H.M.S.O., price 4/6 net.

European Economy.—The June number of the Economic Bulletin for Europe (H.M.S.O. 3/6) contains a number of articles on economic developments in Russia and in Eastern European countries as well as an interim review of the mathematical techniques the use of which is presently being envisaged for economic planning in the U.S.S.R. The continued economic expansion and the future policies and prospects of western European countries are also dealt with.

Forest Products Research.—Increased research on home-grown timber for the Forestry Commission features among the work of the Forest Products Research Laboratory of the Department of Scientific and Industrial Research, according to the laboratory's annual report (H.M.S.O. 5/6 net). The commission considers that its research requirements in this field are likely to increase even more during the next few years. The investigations are designed to assist the commission in deciding both the most economical way of using its timber and its future planting policy. Details of these and other researches undertaken during 1959 are given in the report.

Nuclear Engineering Abstracts.—A new quarterly journal of this title has appeared to record in abstract form an indication of what has appeared in print in the nuclear engineering field during the preceding three months. In each case the main abstract is in English and summaries in French and German are appended. The work is systematically planned and the abstracts in this first issue have been carefully prepared and are well presented. The new quarterly is published by Silver End Documentary Publications Limited, 9–11 Tottenham Street, London W1. The annual subscription is £6 6s.

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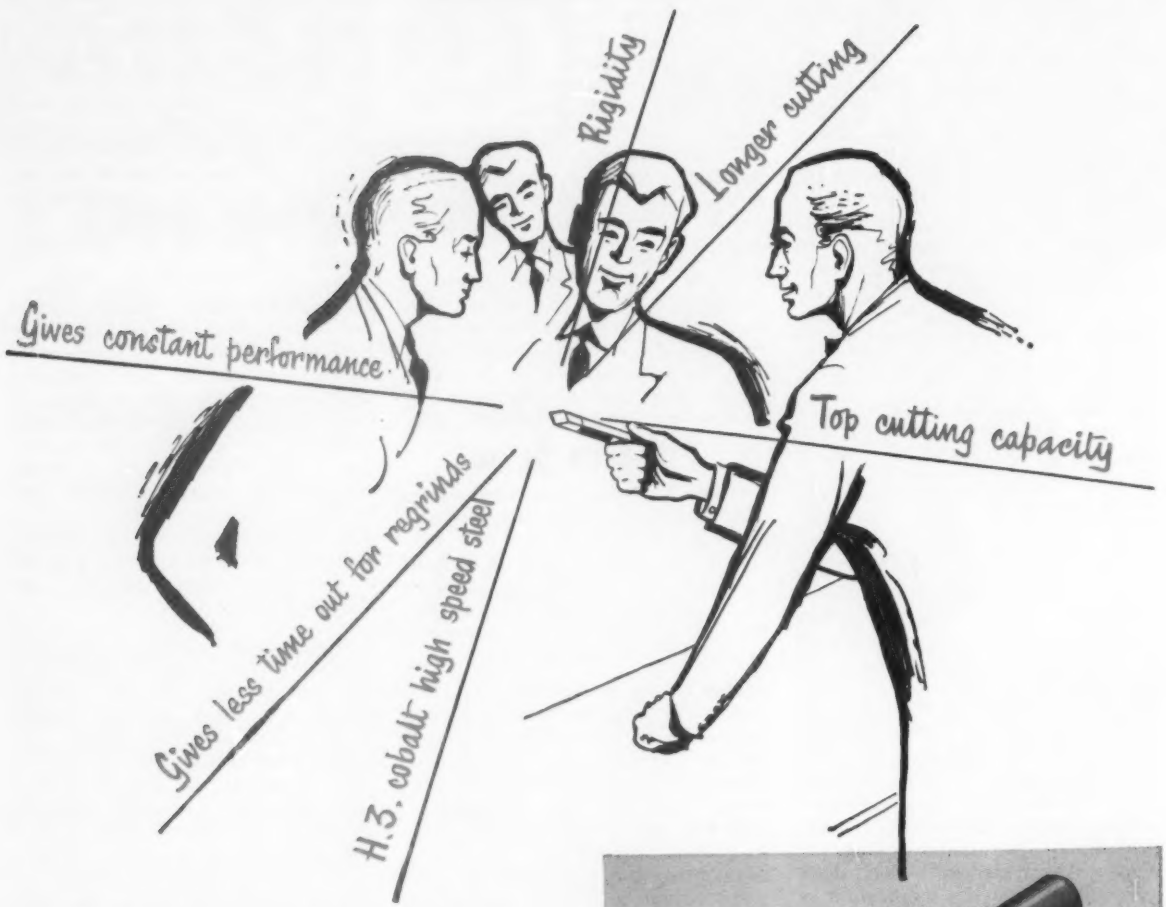

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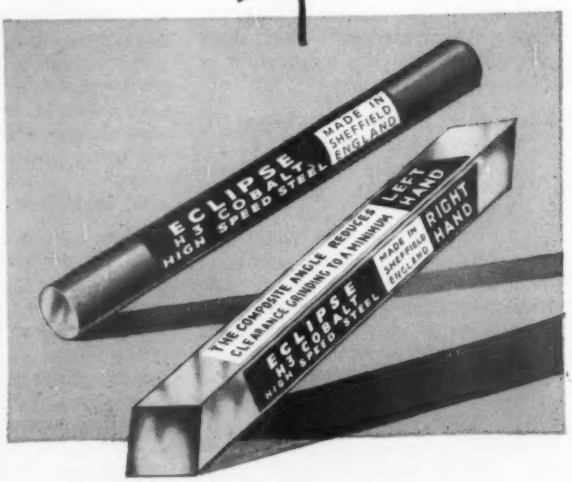

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UTIS

Transport Crisis.—The Road and Rail Association have published their first two pamphlets, dealing, not unexpectedly, with Britain's transport crisis. These are: "A Conservative's View" by Geoffrey Wilson, M.P., chairman of the Conservative Transport Committee in the House of Commons, and "A Socialist's View", by Ernest Davies, formerly Labour's chief Commons spokesman on transport and now editor of *Traffic Engineering and Control*. With the aid of these two ably presented if opposing views, the reader should be able to obtain a clearer picture of the transport scene. Both pamphlets are published for the Association by Arthur Barker Limited at one shilling each.

New Standards

Polythene insulation and sheath of electric cables (B.S. 3234:1960). Price 4/-.

This new standard is the third in the series dealing with various kinds of insulation and sheath for electric cables. Three main kinds of polythene compound are recognized, and these are sub-divided into ten types, distinquished by the presence or absence of poly*iso*butylene (or butyl rubber) and carbon black. Tests are specified for melt flow index, tensile stress and elongation at break, power factor and permittivity, carbon black content and dispersion, residual antioxidant, poly*iso*butylene or butyl rubber content, and colour stability.

Cartridge Fuses for Aircraft (B.S.G. 176:1960). **Part 1: General requirements.** Price 7/6. **Part 2: Cartridge fuses and fuse links.** Price 15/-.

Part 1 of this new standard specifies general requirements for the construction, performance and testing of cartridge fuses for aircraft; Part 2 specifies the dimensions and performance of a particular range of aircraft fuses (Type A) known as the "inter-service type". These fuses are suitable for use in all types of aircraft and on all types of aircraft electrical systems. They are intended to satisfy British Service and civil airworthiness requirements. When all the parts have been published B.S. G176 will cover in a series of separate publications the entire range of fuses for aircraft applications. Unless otherwise stated, the requirement of Part 1 will apply to the items detailed in subsequent parts of the standard.

Glossary of Terms used in Telecommunication (including radio) and electronics (B.S. 204:1960). Price 35/-.

The 2700 definitions in this new 350-page volume represent a decade's work on the part of one of B.S.I's many committees of experts. The standard brings together all the terms previously dealt with in the 1943 edition and the various supplements published between 1948 and 1951. The glossary contains many new terms and definitions and where necessary many of the definitions have been extensively revised. Additions to the publication are a treatment of the terminology of semi-conductor devices, and data on information theory and inductive co-ordination.

Cables and flexible cords insulated with varnished cambric and heat-resisting fibre (B.S. 3249:1960). Price 5/-.

This new publication replaces the part of B.S. 1327:1946 that dealt with flexible cords insulated with varnished cambric and asbestos. The standard, however, includes cables and flexible cables as well as flexible cords, for working voltages up to 660 V; and permits the use of glass fibre and polyethylene terephthalate fibre in place of asbestos fibre. The cables and cords are suitable for use in dry situations only at a maximum conductor temperature of 85°C.

Hand-operated chain pulley blocks (B.S. 3243:1960). Price 5/-.

This standard specifies requirements for rating, factor of safety, tests, marking—and certain details regarding the construction of the block. The materials used for the block are required to comply with certain specified British Standards, or alternatively, to have the essential qualities laid down in those specifications. The manufacturer is required to declare the operating effort and the velocity ratio, although limits to these values are not laid down. A dynamic test with one-and-a-half times the safe working load is required; and there is an optional static test involving the application of twice the safe working load. Two types of chain are specified as alternatives, higher tensile steel chain to B.S. 1663, and alloy steel chain to B.S. 3114. There are appendices containing technical advice on the design of connecting links, etc.

British Standards Institution, 2 Park Street, London W1.

German Standards in English.

The following German standards have been translated into English by Deutscher Normenausschuss, Berlin W15, Uhlandstrasse, 175. The Universal Decimal classification numbers and titles are given in italics.

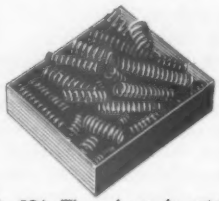
UDC 532 Fluid mechanics; 1342 Viscosity of Newtonian fluids (April 1957); *UDC 620.1 Materials testing*, 50049 Certificates for materials (April 1960); *UDC 621–777 Indentification markings*, 51502 Lubricants; designation of lubricant containers, lubricating appliances and lubricating points, specifications (March 1960); *UDC 621.73 Forges*, 17673 Copper wrought alloys; brass drop forgings, technical supply conditions (April 1957); *UDC 621.882.082 Screw threads*, 2999 Whitworth pipe threads for threaded tubes and fittings; cylindrical internal thread and tapered outside thread (May 1960); *UDC 621.89 Lubrication, Lubricants: oils and greases;* 51505 Lubricants; dark lubricating oils, minimum requirements (October 1959), 51822 Lubricating greases; adhesive grease, minimum requirements (November 1957); *UDC 662.75 Liquid fuels*, 51630 Special grades of petroleum spirit; petroleum ethers, minimum requirements (April 1956), 51631 boiling range petroleum spirits, minimum requirements (January 1959), 51632 white spirits, minimum requirements (April 1956), 51634 safety lamp petroleum spirit, minimum requirements (January 1959), 51635 FAM standard petroleum spirit, requirements (February 1956), 51636 Liquid fuels; illuminating, heat, and solvent kerosene, minimum requirements (January 1959); *UDC 662.76 Gaseous fuels, Gas producers*, 51621 Liquid gas; quality requirements (March 1956), 51622 propane, propylene, butane and butylene, quality requirements (March 1956); *UDC 662.76: 620.1 Testing of gaseous fuels*, 51610 Testing liquid gas; sampling (March 1956); *UDC 669.2/.8 Non-ferrous metals*, 17663 Copper wrought alloys; German Silver, composition, guiding lines for use (August 1954×), 17664 copper nickel alloys, composition, guiding lines for their use (May 1956×); *UDC 669.2/.8-41 Sheets, Strips*, 17605 Sheet and strip of highest grade aluminium and highest grade aluminium wrought alloys, rolled, mechanical properties (November 1956); *UDC 669.2/.8-42 Profiles*, 17672 Copper wrought alloys; brass bars, wire, and sections (April 1957).

THAT *Experimental Spring* YOU WANT IS WAITING FOR YOU IN THIS BOX ...

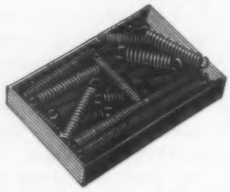
No. 1217. One gross Assorted Springs. A complete Garage Service Kit. 42/- each.

If not, try another box in the Terry Assorted Springs range

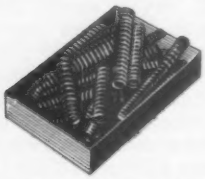
No. 1200. Three dozen Assorted Light Expansion Springs, suitable for carburettor control, etc. **13/6.**



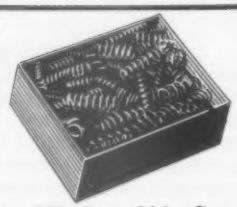
No. 98A. Three dozen Assorted 1″ to 4″ long, ½″ to ⅝″ diam., 19G to 15G. **5/6.**



No. 753. Three dozen Assorted Light Expansion ¼″ to ½″ diam., 2″ to 6″ long, 22 to 18 S.W.G. **10/6.**



No. 760. Three dozen Assorted Light Compression Springs. 1″ to 4″ long, 22 to 18 S.W.G., ¼″ to ½″ diam. **6/6.**



No. 757. Extra Light Compression, 1 gross Assorted, ⅛″ to ⅜″ diam., ½″ to 2½″ long, 27 to 19 S.W.G. **15/-.**

No. 758. Fine Expansion Springs. 1 gross Assorted ⅛″ to ⅜″ diam., ¼″ to 2″ long, 27 to 20 S.W.G. **15/-.**

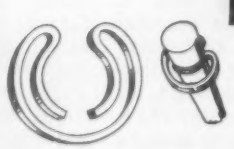
We know *exactly* how difficult it is to find springs for experimental work . . . we've been making quality springs for over 100 years. So, we confidently offer you our excellent range of small boxed assortments which covers a very wide range.
We can only show a *few* boxes. Send us a p.c. for our full list.
If ever you are stuck with a spring problem let our Research Department put their long experience at your disposal.

Have you a Presswork problem?

If so, the help of our Design Staff is yours for the asking.

TERRY'S *for SPRINGS*

Really interested in Springs? "Spring Design and Calculations" 9th Edition tells all—post free 12/6.



Cut Production Costs with Terry's Wire CIRCLIPS. We can supply immediately from stock—from ⅛″ to ⅜″.

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(Makers of Quality Springs, Wireforms and Presswork for over 100 years)

HT30

BUSINESS & PROFESSIONAL

BRITISH INSULATED CALLENDER'S CABLES Limited announce the following appointments; **Mr. H. F. Akehurst, B.Sc., A.M.I.E.E.,** previously director (overseas operations), **Mr. R. M. Fairfield, B.Sc.(Eng.) M.I.E.E., M.I.Mech.E., Fel.A.I.E.E.,** previously director (home operations), and **Mr. W. C. Handley, B.Sc.Tech., M.I.E.E.,** previously director (home group co-ordination) to be assistant managing director of the company. **Mr. E. Bowyer, J.P., B.Sc.Tech., M.I.E.E., A.M.I.M.E.,** and **Mr. C. H. Broughton Pipkin, A.M.I.Mech.E., M.I.E.E.,** to be executive directors of the company. **Lt. Gen. Sir Ronald M. Scobie, K.B.E., C.B., M.C.,** who has been a director of the company since September 1947, has resigned from the board.

THE L. S. STARRETT COMPANY LIMITED, Jedburgh, Roxburghshire, manufacturers of measuring tools and precision instruments announce the appointment of **Mr. G. B. Seyman** as sales manager and **Mr. Alexander McKay** as works manager.

Mr. H. Stanesby has been appointed deputy director of research at the Post Office. He is at present staff engineer in the Radio Planning and Provision Branch of the GPO Engineering Department.

ENGLISH ELECTRIC announce that **Mr. H. Sammons, C.B.E.,** is to retire from the position of managing director of their subsidiary D. Napier & Son Limited at the end of this year. Mr. Sammons has been with the company since 1942, and will be 65 years of age in February 1961. **Mr. H. E. C. de Chassiron, C.B.E.,** has been elected to the board of D. Napier & Son Limited, and has been appointed managing director designate. He will succeed Mr. Sammons as managing director of Napiers on January 1, 1961.

R. & A. MAIN LIMITED announce the appointment of **Mr. J. Wortley, B.Sc., A.M.I.Mech.E.,** as managing director of the company.

Mr. John Boardman has been appointed deputy chairman of U.S. Industries Inc. (Great Britain) Limited, with effect from September 1, 1960.

Dr. Richard V. Waterhouse, M.A., has been appointed managing director of Acoustical Investigation and Research Organization Limited (118 Cromwell Road, London SW7)—known as AIRO—a member of the Hall-Thermotank Group.

METAL INDUSTRIES LIMITED announces the following appointments: **Mr. D. L. Freeman** has been made a director of Cox & Danks Limited, responsible for the London branch of the company. **Mr. B. W. G. Gurney** has been appointed managing director of Farmer Brothers (Shifnal) Limited. **Mr. C. G. Abel** has been appointed general sales manager of Farmer Brothers.

Mr. E. H. S. van Someren has recently joined the British Welding Research Association as a principal scientific officer and is to work on fundamental studies on the physics of the welding arc by optical observations.

ASSOCIATED ELECTRICAL INDUSTRIES (Rugby) Limited. **Mr. Oswald Arthur Pallett, M.P.O.A.,** for many years supervisor of purchases for the British Thomson-Houston Company, now AEI (Rugby) Limited, has retired after forty-eight years' service. Mr. Pallet had been acting as a consultant since January of this year, when he was succeeded as supervisor of purchases by **Mr. L. C. J. Carvill.**

Transformer Division. The following appointments are announced: **Mr. D. R. Clegg,** manager, transformer sales department (Manchester); **Mr. W. S. Perkins, A.C.G.I.,** manager, transformer sales department (Rugby). Engineering appointments: **Mr. G. J. Hodgkinson,** assistant chief engineer (design), transformer engineering department (Manchester); **Mr. E. R. Hartill, B.Sc.(Eng.).Hons.Lond., A.M.I.E.E.,** assistant chief engineer (development), transformer engineering department (Manchester); and **Mr. G. N. Leech, B.Sc., A.M.I.E.E.,** assistant chief engineer, transformer engineering department (Rugby). **Mr. R. H. Thornicroft** has been appointed deputy manager, traffic department, AEI (Rugby) Limited.

Mr. Peter B. Hamilton has been appointed personal assistant to Mr. Charles W. Hayward, chairman of the Firth Cleveland Group. Mr. Hamilton was previously with the Solartron Electronic Group Limited, where he was sales manager of the products sales division (Farnborough). RICHARD HILL LIMITED, a member of the Firth Cleveland Group of Companies, have made two new appointments to their board. **Mr. A. W. Thwaites** becomes commercial director, previous to which he was commercial manager; **Mr. H. M. Macgregor** formerly works manager, becomes works director.

Mr. W. M. H. Stevens, A.M.I.Mech.E., M.S.A.E., has been appointed deputy chairman and joint managing director of Firth Cleveland Pumps Limited, Premier Works, Earl Shilton, Leicester, a member of the Firth Cleveland Group. Mr. Stevens was formerly the technical director of Bowser International Limited.

SQUARE D LIMITED announce the appointment of **Mr. A. S. Paice** as their export co-ordinator based at their Swindon Headquarters. Prior to this appointment Mr. Paice was the company's Midlands area manager to which post he is succeeded by **Mr. R. Ritchie.**

BRAY CONSTRUCTION EQUIPMENT LIMITED, Faggs Road, Feltham, Middlesex, announce the appointment of **Mr. W. Muir** as London manager.

Mr. Stanley K. Wheatley has been appointed a director of the Sheffield Wire Rope Company Limited, a member of the Firth Cleveland Group.

Lt.-Cdr. R. B. Lakin, D.S.O., D.S.C., has been appointed a director of Vickers-Armstrongs (Engineers) Limited with effect from September 5, 1960, and general manager of that company's North East Works in succession to **Mr. J. R. Kelly** who has reached normal retirement age.

SIR W. H. BAILEY & CO. LIMITED, (Albion Works, Patricroft, Manchester) announces the appointment of **Commander E. G. Sutton, M.I.Mech.E., R.N.(Rtd.),** as works director.

UNION CARBIDE LIMITED announce the appointment of **Mr. W. B. Whitworth** as sales manager of the Alloys Division.

Mr. Edward T. (Ed) Green, A.R.T.C., A.S.M.A., has been appointed industrial sales manager to J. I. Case Company Limited, concentrating on the coal, electricity, gas and chemical industries.

Mr. A. R. Jackson has been appointed to the board of the Consolidated Pneumatic Tool Company Limited, of 232 Dawes Road, London SW6. Mr. Jackson is general manager of the company's Australian branch and will continue in charge of operations in that country.

Lord Tweedsmuir has been appointed a director of The Cementation Company Limited.

EXPANDITE LIMITED, the jointing, waterproofing and corrosion specialists, announce the appointment of **Mr. J. H. Price** as general manager of their Australian Company, Expandite (Australia) Pty. Limited. Mr. Price left England on September 9 to take up his post in Australia. He will take over from **Mr. J. M. Robb** who is returning to the parent company where he will hold an important position in the overseas development division of the Expandite Group.

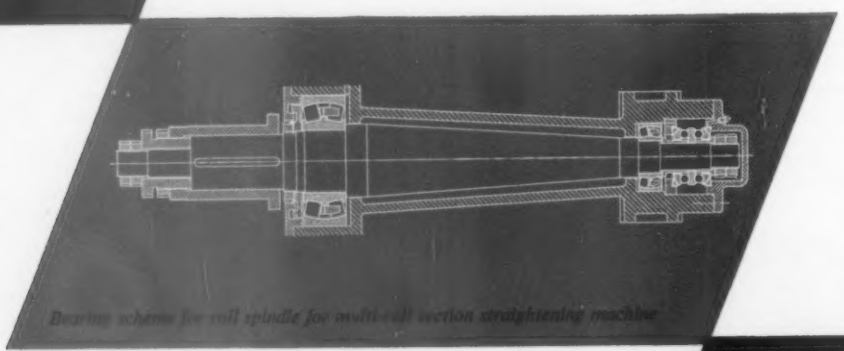
Mr. Eric Newbigging, B.Sc.(Econ)., M.S.M.A., has joined Stanley Works (G.B.) Limited, makers of Stanley tools, as sales promotion manager.

BRITISH INSULATED CALLENDER'S CABLES Limited announce the appointment of

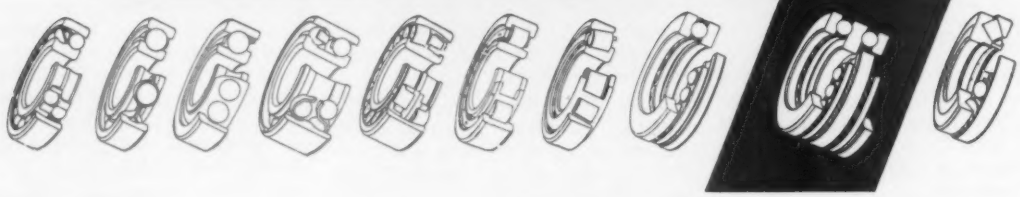
Only SKF can offer such a wide selection of British made bearings

Where exclusively axial loads are to be dealt with acting in either direction, the double thrust ball bearing may be used. This bearing has two rows of balls, one for thrust in each direction. The centre ring is the shaft ring in metric sizes ; the housing rings may have either a flat or sphered seating. In inch sizes the centre ring is the housing ring.

This is one of the ten variants of the four basic rolling bearing types ; Skefko is the only British manufacturer making all four and can therefore offer completely unbiassed advice on the choice of bearing types for any specific problem.



Bearing scheme for roll spindle for multi-roll section straightening machine



THE SKEFKO BALL BEARING COMPANY LIMITED · LUTON · BEDS

THE ONLY BRITISH MANUFACTURER OF ALL FOUR BASIC BEARING TYPES: BALL, CYLINDRICAL ROLLER, TAPER ROLLER AND SPHERICAL ROLLER

G182A

Mr. D. G. Denoon as public relations manager of the BICC Group.

Mr. Alan E. Cairney has moved to the Glasgow office of York Shipley Limited, where he will take charge of all industrial contracts.

BRITISH GEON LIMITED has recently made the following appointments. **Mr. A. H. Fletcher** as sales manager, Geon PVC resins and latices; and **Mr. H. A. Wardle** as sales manager for Hycar nitrile rubbers and acrylates. Both these appointments are promotions within Distillers Plastics Group. **Mr. D. J. Pretorius,** who has joined the company from National Chemical Products Limited, South Africa, will act as sales manager, Geon PVC compounds. The following have been promoted to new posts in British Geon's technical service department: **Mr. E. J. Hoskins** to be technical service manager, Geon PVC dispersion resins; **Mr. W. S. Mure** to be technical service manager, Geon PVC pastes and latices; **Mr. S. Mottram,** at present technical service manager to be chief technical service manager.

PANELLIT LIMITED, a member company of the Elliott Automation Group, has appointed **Mr. R. S. Glaister** as customer liaison engineer.

Mr. Richard Miles, who retired recently as chairman of Head-Wrightson & Co. Limited, has been appointed a director and chairman of Joy-Sullivan Limited, Greenock, Scotland, manufacturers of mining machinery and compressed air equipment.

HAMWORTHY ENGINEERING LIMITED of Poole, Dorset, announce that **Mr. R. J. Gates,** at present technical director of the Pool and Ropner Shipping Companies Limited, is joining them as director and executive assistant to the managing director, to give support to the company's expansion programme.

Mr. G. E. Dix, who joined Massey-Ferguson at the end of 1959, has been appointed general purchasing manager, U.K. operations. Mr. Dix will be succeeded as purchasing manager of Massey-Ferguson's Banner Lane Plant by **Mr. D. W. Stevens.**

Mr. W. J. Renton has joined the company as general shipping and traffic manager.

Mr. W. A. Attwood, M.A., A.M.I.Mech.E., M.I.H.V.E., has been appointed H.M. Senior Engineering Inspector of Factories, in place of **Mr. H. Eccles, O.B.E., M.C., A.M.I.C.E.,** who retired on September 30, 1960.

BLAW KNOX CHEMICAL ENGINEERING Company Limited announces the appointment of **Mr. Maurice W. Vincent, B.Sc., A.R.I.C.,** as technical sales manager.

Mr. Alfred Ratcliffe has been appointed a director of Metals Division, Imperial Chemical Industries Limited, and a joint managing delegate director of Marston Excelsior Limited, a subsidiary company of I.C.I. At Marston Excelsior, he has succeeded **Mr. W. Robson** who retired on September 30. Mr. Robson joined I.C.I. at Billingham in 1927.

Mr. Stanley Jessop has resigned as sales manager of Fredk. Town & Sons Limited, Halifax, and Woodhouse and Mitchell, Brighouse, both subsidiaries of Thos. W. Ward Limited, Albion Works, Sheffield. He is rejoining the parent company on special duties in connexion with its engineering activities in Scotland.

Mr. Ernest W. Hancock, O.B.E., M.I.Mech.E., has joined Production-Engineering Limited as an associate consultant.

Mr. George A. Smith has been appointed commercial executive of The Plessey Company Limited.

Mr. George Kenneth Medlock, J.P., A.M.I.Mech.E., has been elected a director of the £467 million Co-operative Wholesale Society Limited. Mr. Medlock, who is 46, is the chief engineer of the C.W.S.

Obituary

WE regret to record the death of **Mr. E. T. W. Barnes, A.M.I.E.(Aust.), A.M.I.Prod.E.,** manager of manufacturing, AEI Electronic apparatus division, New Parks, Leicester.

Addresses

ALCAN INDUSTRIES LIMITED is the new name for Northern Aluminium Company Limited. No other change is involved and the trade name 'Noral' will be retained.

ALBRIGHT & WILSON (MFG.) LIMITED have opened a sales office in Belfast in Imperial Buildings, 72 High Street. (Telephone No. Belfast 32312—Telegraphic address, Albriwil—Belfast), under the managership of Mr. W. Kerr.

F. J. EDWARDS LIMITED, Edwards House, 359-361 Euston Road, London NW1 has a different telephone number—Euston 5000. Telex No. 24264. Answer-back code; Bescotools London.

THE name of one of the principal subsidiary companies of Darlington Chemicals Limited, the British Refrasil Company Limited, Stillington, Co. Durham, has been changed to Darchem Engineering Limited. Ownership and board of the company remain unaltered and all existing activities will continue.

THE machine, jig and fixture division of The Brooke Tool Manufacturing Company Limited, Cardinal Works, Aldridge Road, Perry Barr, Birmingham 22b. has been reconstituted as a new company known as Brooke Tool Automation Limited.

JARROW METAL INDUSTRIES LIMITED a wholly owned subsidiary of Armstrong Whitworth (Metal Industries) Limited will in future, be known as Armstrong Whitworth (Metal Industries) Limited, Western Road Works, Jarrow, Co. Durham. Tel. Jarrow 89-7111. Telegrams: Metalloy, Jarrow. Telex: 53139 Metalloy, Jarrow.

GRIFFIN & GEORGE GROUP OF COMPANIES, Alperton, Middlesex, have opened new Scottish warehouse sales and servicing centre and offices at Braeview Place, Nerston East Kilbride, Scotland. The branch manager is Mr. R. Carrington, and Mr. James Baxter the field sales manager. Also a new Northern sales and service centre at Ledson Road, Wythenshawe, Manchester 23, has been opened.

PRECISION COMPONENTS (BARNET) LIMITED of Kabi Works, Cranborne Road, Potters Bar, Middlesex, has changed its name to include the trademark Kabi and will in future be known as Kabi (Electrical and Plastics) Limited.

Educational Trust

THE GAUGE AND TOOL MAKERS' Association is establishing a body to be known as The Gauge and Tool Makers' Educational Trust, the objects of which will broadly be: to provide funds for the furtherance of technical education in Great Britain and elsewhere to apprentices, students, etc; to promote knowledge of the products covered by the gauge and tool industry; to arrange exhibitions and provide demonstrations; and to establish and support or aid in the establishment and support of any educational charitable association or institutions, etc.

A company to be known as The Gauge and Tool Makers' Trustee Company Limited is being formed to act as the trustee of the trust.

Standards Associates

A MEETING held recently at British Standards House in London of over 100 engineers and others concerned with the application of standards in industry gave its support to a new scheme sponsored by the British Standards Institution for a "Register of Standards Associates". The objects of the scheme were agreed to be:

"To provide a forum for those connected with standards matters, to increase knowledge and develop techniques in order to further the aims and practice of standardization, generally through discussion and dissemination of information."

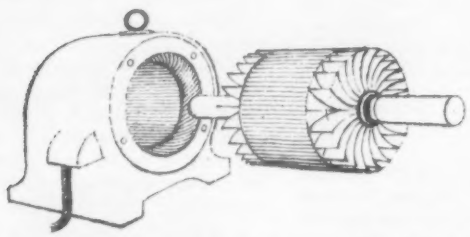
Those on the register will become associates of the B.S.I. The initial annual subscription to join is one guinea and should be sent, together with the applicant's address for correspondence, the name of his organization and his position in it, to the Joint Secretary, I.Prod.E./B.S.I. Committee, British Standards Institution, 2 Park Street, London W1.

Electric Motors & Controls 1

Most manufacturers today employ electric motive power through individual drives, which, among their many advantages, permit the right type of motor to be used for each of various types of machine. The range of motors available—each with its own characteristics—is very large, and the factory executive could well be guided in his choice by the expert views of the motor manufacturer, the installing engineer or his Electricity Board's engineer. The characteristics of the main types of motor are briefly summarised below.

Squirrel-cage Motors

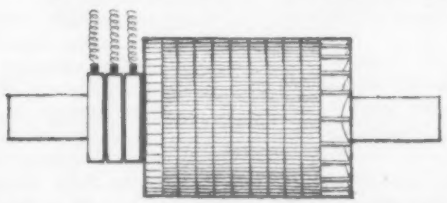
These are the most straightforward and simple in design, and are therefore relatively cheap and robust in character. They should be considered for general duties and, in conjunction with variable-speed gears or couplings, for applications requiring variable speeds, e.g. for crane drives. Small sizes can be switched direct-on-line.



The squirrel-cage motor is very suitable for individual drive of each motion of single-purpose machine tools where the motor horsepower can be precisely specified. It is suitable for driving pumps, fans, lifting hoists and woodworking machines. Textile machinery represents another field of use.

Slip-ring Motors

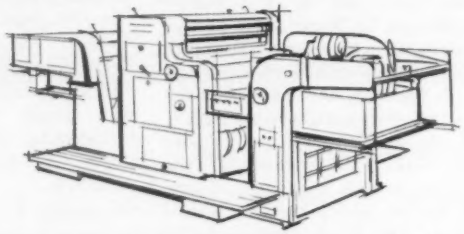
The chief advantage of the slip-ring motor is a very low starting current for a given torque, e.g. full-load torque at starting with a current about 10% above full-load current. This makes it suitable for applications requiring a prolonged starting period with a



load of high inertia. It also permits of speed variation below synchronous speed, though with some loss of efficiency. Typical applications include fans, pumps, heavy lathes, grinders and boring mills, as well as calendering machines, cable-laying-up machines and mine hoists.

Three-phase A.C. Commutator Motors

The main characteristic of this type is variable-speed with uniform and gradual acceleration and good efficiency over the speed range. Paper manufacture provides excellent examples of its use, e.g. in paper-making, reeling, cutting, calendering, coating and drying.



A.C. commutator motors are recommended for mechanised bakeries and for cranes and hoists where very slow speeds are frequently needed.

Synchronous Motors

These are constant-speed motors. One particular advantage is that they can be operated at unity or even at leading power factor to correct a system suffering from lagging power factor, and perhaps so qualify for a reduction in the electricity bill. Pump and compressor drives are typical uses to which they can be put. They are also used in motor-generator sets.

Single-phase A.C. Motors

In general, single-phase motors are used in light industries for drives not requiring more than about five horsepower or where a three-phase supply is not available. While their use is mainly limited to work of a light nature, they do fill a need in such duties as sewing-machine drives, portable hand tools, window opening and closing gear, etc.

Direct Current Motors

For a completely unfettered performance where wide ranges of speed variation, high rates of acceleration and powerful dynamic braking are all-important, the D.C. motor is unrivalled. This means in effect the installation of an A.C.-D.C. motor-generator set or rectifier to give the necessary supply, but the increased cost may well be compensated by the improvement in productivity. When variable voltage is applied to the armature, a wider speed range is obtainable than with any other type of motor. Typical applications of the D.C. motor are: cranes, haulage and tippler equipment, certain machine tools requiring a large speed range and smooth acceleration, high-speed printing and steelworks drives.

For further information, get in touch with your Electricity Board or write direct to the Electrical Development Association, 2 Savoy Hill, London, W.C.2. TEMple Bar 9434.

They can offer you excellent reference books on electricity and productivity (8/6, or 9/- post free)—"Electric Motors and Controls" is an example.

E.D.A. also have available on free loan within the United Kingdom a series of films on the industrial uses of electricity. Ask for a catalogue.

7914

Film News

The World Turns.—Dealing with the power, accuracy and versatility of Colchester lathes, this film also highlights certain production processes used in their manufacture. In full colour 16 mm copies are now available on loan to engineering societies, apprentice training schools and technical colleges and application should be made to R. C. M. Budgen, Publicity Manager, The Colchester Lathe Company Limited, Hythe, Colchester, giving alternative dates on which the film would be required.

European Management Consultants Unite

THE formation is announced of a Federation of European Management Consultants, F.E.A.C.O. (Fédération Européenne des Associations de Conseils en Organisation). Countries in initial membership are: U.K., France, Sweden, Holland, Switzerland and West Germany.

Staff Status

STAFF status is to be given to all skilled male workers who have been with Tecalemit Limited ten years or more and who are at present hourly paid. This means that all the men in this group will enjoy an extra week's annual leave with pay as well as full pay for several weeks if they fall sick.

Contracts and Work in Progress

ASSOCIATED ELECTRICAL INDUSTRIES Limited.—Air Ministry order for £600,000 AEI 1010 data processing system for R.A.F.

Contract from South of Scotland Electricity Board for the supply and erection of crossing towers, anchor towers and conductors for the crossing of the river Clyde by the 275kV supergrid near Erskine Ferry, Nr. Glasgow.

Contract valued at more than £½ million for the 33kV and 11kV cable installation of the new Spencer steelworks being built by Richard Thomas & Baldwins at Newport, South Wales.

FILM COOLING TOWERS (1925) LIMITED, Richmond.—Contract for three large natural draught water cooling towers for CEGB at Richborough Power Station, Kent.

SOLARTRON ELECTRONIC GROUP LIMITED, Farnborough.—Ministry of Aviation order for new digital Solartron-Analogue computer.

SOLARTRON LABORATORY INSTRUMENTS Limited, Chessington (subsidiary of Solartron Electronic Group Limited).—Contracts totalling £250,000 for the supply of Solartron oscilloscopes to the Admiralty and Ministry of Aviation.

QUICKSET WATER SEALERS LIMITED (Cementation Group of Companies).—Contract for the supply of a special non-ferrous aggregate, Diamond Betonac, to the factory being built at Basingstoke for Lansing Bagnall Limited in the first stage for 90,000 sq ft of flooring.

E.M.I. ELECTRONICS LIMITED.—Contract from the Swedish Government for the latest type of mobile army radar equipment.

TAYLOR WOODROW CONSTRUCTION LIMITED.—Mechanical equipment valued at approximately £½ million for the new compound mill for the British Extracting Company Limited of Bromborough Port, New Ferry, Birkenhead.

INCANDESCENT HEAT COMPANY LIMITED.—Contract worth approximately £55,000 for equipment to be installed in a large Belgian steelworks.

HEENAN & FROUDE LIMITED.—Large hydraulic dynamometer, the fourth of this size to be installed by Fiat of Turin.

DAVID BROWN AUTOMOBILE GEARBOX Division.—1000 David Brown 5-speed gearboxes for lorries of 12/14 tons gross weight ordered by British commercial vehicle builder at the Commercial Motor Show. This follows a £90,000 order received on the first day of the Show.

BRITISH RAILWAYS—Scottish Region.—Contract for diesel fuelling and maintenance facilities at Eastfield motive power depot, Glasgow, awarded to Jas. Campbell & Son, Inverness. Two rail planing machines for Kilmarnock permanent way workshops ordered from Butler Machine Tool Company Limited, Halifax. Heavy duty wheel lathe, Townhill wagon repair depot, Dunfermline, from Scottish Machine Tool Corporation Limited, Johnstone.

PETBOW LIMITED.—Order for three emergency generating sets for John Brown & Co. (Clydebank) Limited to be installed in the new Union Castle liner *Transvaal Castle*.

PERKINS ENGINES LIMITED, Peterborough.—Order totalling nearly £150,000 for four cylinder diesel engines for use in German-built fork lift trucks received from Ruhr Intrans Hubstapler G.m.b.H. of Mulheim.

4-D ASSOCIATES LIMITED.—A second Leo computer for installation at the offices of W. D. & H. O. Wills branch of the Imperial Tobacco Company at Bristol.

QUASI-ARC LIMITED, Bilston, Staffordshire.—Complete automatic welding installation for the fabrication of "pen-stock" pipes ordered by Sulzer Brothers of Winterthur, Switzerland.

WILD-BARFIELD ELECTRIC FURNACES Limited.—Among equipments being manufactured for overseas customers are nearly fifty furnaces for India, varying from small muffles for laboratory and technical school use to large equipments for full-scale production applications and including toolroom and high temperature models. Included in export orders to Belgium is one for a Wild-Barfield/NRC Model 2801 C Crystal pulling furnace, and a large high temperature furnace destined for the Royal New Zealand Air Force. In addition to laboratory and toolroom equipment being manufactured for Canada by Wild-Barfield, five special kilns and a large glass annealing lehr are being made by the Applied Heat Company Limited, a Wild-Barfield subsidiary.

Business Developments

Trading agreements

WICKMAN LIMITED have acquired sole selling rights in the U.K. for the range of machine tools produced by The Gisholt Machine Company, Madison, Wisconsin, U.S.A. and its associated subsidiary company Gisholt Machine Company (Great Britain) Limited.

VICKERS-ARMSTRONGS (ENGINEERS) LIMITED and Racine Hydraulics & Machinery Incorporated of Racine, Wisconsin, U.S.A. have reached agreement whereby the two companies jointly develop their hydraulic interests and manufacture and sell each others hydraulic products.

SMITHS INDUSTRIAL DIVISION and The ABEM Company, Stockholm, have each appointed the other as sole distributor of their high speed pen recording and laboratory equipment in specified areas.

BURTONWOOD ENGINEERING COMPANY Limited, Warrington.—Arrangement with J. H. Vivian & Co. Limited of Johannesburg to stock and sell all varieties of oil seals made by Burtonwood.

Agents and distributors

C. H. JOHNSON (MACHINERY) LIMITED, Contractors Plant Division, Stockport, have appointed the following companies as their spares and service agents: G. S. Amos & Co. Limited, 264 Highbridge Road, Wylde Green, Sutton Coldfield. Telephone: Sutton Coldfield 5665; Marshall Branson Limited, Chainbridge Road, Blaydon-on-Tyne. Telephone: Blaydon 390. Telex No. 53125; George Smith (Compressors) Limited, 119 Whitefield Road, Govan, Glasgow, SW1. Telephone: Govan 2701.; Pannell (Plant) Limited, Torre Hill, Plymstock, Plymouth, Devon. Telephone: Plymstock 2518; Gould Plant Hire Limited, Eastern Drydocks, Newport, Mon. Telephone: Newport 72461; West Plant Limited, 6-8 Cambridge Street, Wells Road, Bristol 3. Telephone: Bristol 75511.

Company acquisitions

YORKSHIRE IMPERIAL METALS LIMITED in agreement with the Delta Metal Company Limited have acquired the business of Booth & Mapplebeck Limited, a member of the Delta Group.

CHARLES CHURCHILL & Co. LIMITED have acquired control of Newcast Foundries Limited of Newcastle-under-Lyme, Staffs.

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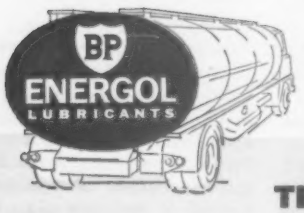

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Centrifugal Fans

The third edition of Publication No. 37 is the first fully descriptive, fully illustrated 48 page catalogue issued by Keith Blackman Limited to describe their range of Type AR, aerofoil section backward bladed centrifugal fans. The first and second editions were in leaflet and folder form. This new, two colour edition provides full details concerning the design of impellers, casings, drive arrangements, bearings, maintenance, etc. plus extensive capacity tables ranging from 1000 to 50,000 cfm with pressures from 1·0 to 15·0 in. swg. Dimension tables and drawings are also included. This efficient and quiet fan is designed for forced and induced draught boiler installations, for air conditioning, ventilation of buildings and mines and general industrial use.

Self-lubricating Bearings

The Self-Lube range of bearing units are now being incorporated in many types of machinery — conveyors, agricultural machines, textile machinery, and special purpose machines. The Self-Lube unit consists of a self-aligning bearing effectively sealed and lubricated for life. They are built into several types of housings and are supplied to suit shafts ½ in. to 6 in. dia. The makers, Pollard Bearings Limited, Ferrybridge, Knottingley, Yorks, have issued a descriptive leaflet.

Process Timer

Elcontrol Limited, Wilbury Way, Hitchin, Herts., have re-issued Data Sheet TR describing their range of electronic process timers, including a new unit type TRU4. While basically similar to the standard TRU range of process timers, the circuit has been designed to give exceptionally high repetitive accuracy, i.e. better than ±0·1% under normal supply conditions. It has been found that even with an exceptionally high mains voltage swing of ±25%, the repetitive accuracy of the TRU4 is within ±0·25%.

Degreasing

Volvite is the trade name for a range of balanced formulations in the alkali, acid and surfactant groups, in both powder and liquid form, manufactured by The Liverpool Borax Company Limited (Andrew Maxwell Division) Maxwell House, St. Paul's Square, Liverpool 3. A brochure describing some of the many uses of the solution, such as cleaning ferrous and non-ferrous metals, degreasing engine and machinery parts, removing paint and barrel polishing, has been issued by the manufacturers.

Sulzer Commemoration

To commemorate its foundation 125 years ago the Swiss firm of Sulzer Brothers Limited, which employs more than 10,000 workers in the manufacture of an extensive range of heavy machinery including thermal plant, steam, diesel and jet engines, hydraulic machinery, and air conditioning equipment, has issued a handsomely bound volume tracing the history of the firm, and describing its products, organization and personnel. Illustrated with brilliant colour photographs it is a fine example of Swiss book production. The London address of the firm is Sulzer Brothers (London) Limited, 31 Bedford Square, WC1.

Feeding and Screening

A leaflet from Magco Limited, Lake Works, Portchester, Hants, illustrates their feeding, conveying and screening products. These include magnetic separators, bin level control systems, bin vibrators and feeders, magnetic crack detectors, and magnetic chucks and drill stands.

Trade Literature

Readers interested in any of the catalogues reviewed here can obtain copies by mentioning* MECHANICAL WORLD *when writing to the firms concerned.

Meters for Liquids

Arkon meters are of the positive displacement nutating piston type, designed to measure precisely the volume of liquid flowing through a pipe. Measurement is accomplished by a single piston displacing a fixed quantity of liquid for each cycle or nutation. The meters can be used for a wide variety of non-corrosive liquids other than water, they operate at any named temperatures up to 200° F and in many cases to 450° F, and are suitable for 150 psi working pressure. The makers, Walker, Crosweller and Company Limited, Cheltenham, Glos., can supply descriptive leaflets.

Instrument Panels

New literature from George Kent Limited, Luton, Beds., contains details and specifications of two basic types of instrument panel, the plate-type manufactured in one section and the unit type built up by combining smaller sections; primary elements for temperature measurement, consisting broadly of resistance thermometers, thermocouples and radiation pyrometers; the Commander boiler-test indicator for measuring steam-turbine condensate flow and boiler feed-water flow to official boiler test standards; and Commander flow measuring instruments—a wide range which includes recorders, indicators, air-operated controllers and air-operated and electric transmitters.

Graphite in the Glass Industry

The use of Foliac products in the glass industry is described in a new illustrated folder from Graphite Products Limited, Northfields, Wandsworth Park, London SW18. Foliac UG 1141 ensures that the glass container is released cleanly from the mould. The lubricant is easy and economical to use: it may be applied as received or thinned with light machine oil. Foliac W18 colloidal graphite in water is used extensively for the pre-treatment of moulds and for coating conveyor belts carrying finished ware.

Terminal Block

Heavy duty terminal block type TER is a compact component capable of carrying heavy currents at medium voltages. It is made of black insulating moulding material with two pairs of nickel plated brass screws connected by nickel plated copper strips. It can be used on voltages not exceeding 650 and the makers recommend the current rating of 100 amp. Other details will be found in a leaflet obtainable from Electrical Remote Control Company Limited, Elremco Works, Harlow New Town, Essex.

Co-ordinate Drilling Machine

The 6 ft × 6 ft Autonomic vertical co-ordinate drilling machine uses a tape preparation system devised to blend in with existing drawing office and planning office routine. The system provides for drilling, reaming, tapping and spotfacing in conjunction with co-ordinate positioning and automatic speed, feed and tool change; control of the machine can be either fully automatic, semi-automatic or manual; drilling capacity is up to 1¾ in. dia in mild steel. The makers, James Archdale & Co. Limited, Ledsam Street, Birmingham 4, have issued a descriptive leaflet.

Tornado PVC Fume Removal Fans

A 28-page illustrated booklet from Keith Blackman Limited, Mill Mead Road, London N17, contains dimensioned drawings and capacity tables covering three types of solid pvc fans: Series 1 centrifugal type with open 'paddle type' impeller, direct driven by totally enclosed motor wound for 1 ph or 3 ph supplies; Series 2 centrifugal type with multiblade forward curved impeller, indirect driven through V-ropes; bifurcated type with 4 or 8 bladed axial impeller and with direct drive, totally enclosed motor wound for 1 ph or 3 ph supplies. Also available from the same company is a catalogue covering Tornado short cased axial fans.

Weatherproofing Compounds

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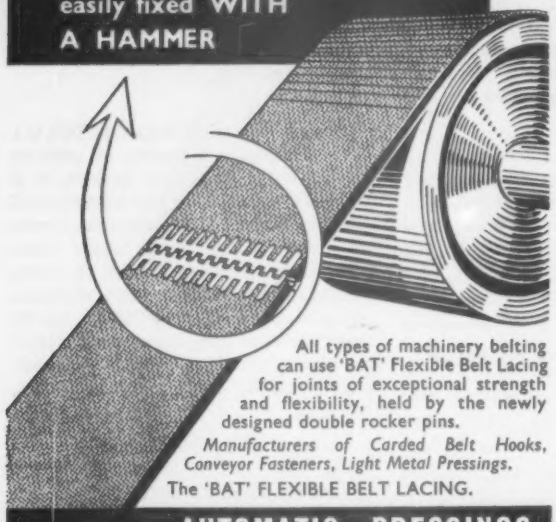

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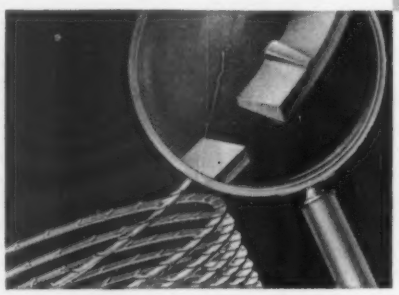

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trowel, putty knife, pressure gun or by hand and Ritolastic by brush or spraying. A leaflet giving fuller details is obtained from Andrew Maxwell Division (The Liverpool Borax Company Limited), Maxwell House, St. Paul's Square, Liverpool 3.

Carburizing Boxes

A leaflet, No. V. 41B, from Thompson L'Hospied & Co. Limited, Amblecote, Stourbridge, illustrates and gives particulars of dimensions for their range of cast nickel chromium rectangular carburizing boxes and cast nickel chromium circular carburizing pots.

Alnwick. B. H. Brown (Engineering) Limited, 22 Main Road, Kenton Bank Foot, Newcastle upon Tyne, are to erect an agricultural machinery sales and service depot on Alnwick industrial estate. No contracts let. Plans by Roger Thornton, consulting engineer, Lloyds Bank Chambers, Newgate Street, Morpeth.

Blyth. L. Wood, mineral water manufacturer, Bridge Street. New factory. The contractors are Atcost Limited, Duke Street, Darlington, in conjunction with R. Hush, Union Street, Blyth.

Brandon (Co. Durham). Durham Divisional Coal Board (No. 5 Area), Beamish Hall, Stanley, Co. Durham. Workshop, stores and offices are proposed at Pit House Colliery.

Chester-le-Street. Graves Limited. Work has started on a large bakery for which the contractors are Wimpey & Co., Fenwick Terrace, Newcastle upon Tyne.

Consett. Carricks (Caterers), Limited, Ponteland Road, Newcastle upon Tyne. The architects for a proposed depot and offices at Consett are Marshall & Tweedy, 36 Blackett Street, Newcastle upon Tyne.

Gateshead. J. Mackay & Co. Limited, Corporation Street, Newcastle upon Tyne, are to convert the Coatsworth Cinema into a soft drinks factory, bottling department, garage, etc.

Smiths Delivery Vehicles Limited. Site works have started for a new factory at Team Valley Trading Estate. The contractors are Dowsett Engineering Contractors Limited, Durham Road, Low Fell.

Haltwhistle (Northumberland). Smith & Walton Limited, paint manufacturers. Approval has been given to a scheme for factory extensions.

Jarrow. Smart & Brown (Machine Tools) Limited, Biggleswade, Bedfordshire, are considering a site at Jarrow for the erection of a factory.

Longbenton (Northumberland). Fewsters Limited, motor engineers, propose showroom, depot and offices at North Road, Seaton Burn. The architect is G. T. Allnutt, 2 The Rise, Newcastle upon Tyne.

South Shields. Mary Harris Limited are to extend their gown manufacturing works at John Clay Street, South Shields. The architects are Waring & Netts, 36 Jesmond Road, Newcastle upon Tyne.

Sunderland. Powley & Son are to carry out extensions to their engineering works at St. Marks Road, Millfield. The architects are S. W. Milburn & Partners.

Industrial Estates Corporation of England, Team Valley, Gateshead. The architects for extending factory at Pallion are Fennell & Baddiley, Bridge End Chambers, Chester-le-Street.

Wallsend. Associated Lead Manufacturers Limited, Crescent House, Newcastle upon Tyne, are to carry out a redevelopment scheme at their Antimony Works, Stephenson Street, Wallsend.

Whitby. Town Tailors Limited. The Urban District Council is to extend the Market Hall, Whitby, which the company is to use for factory purposes. Tenders will be invited for the work as soon as possible. The Council's surveyor is E. W. Royston.

Whitley Bay. Stephens Manufacturers Limited. Extensions are being made to shirt factory at Foxhunters Road. The contractors are R. A. Gofton Limited, Front Street, Monkseaton.

Acton. A. E. Mallandain Limited. Extensions are to be made to the Victoria Paper Mills, Victoria Road.

Arbroath. Francis Webster & Sons Limited. Proposal to extend their factory at Alma Works, Millgate.

Basingstoke. Associated Transistors Limited. A new factory is to be built on Houndsfield industrial estate.

New Factories

Birmingham. Thomas Smith & Sons Limited, Saltley Mills, Alderley Road, Saltley are to erect a new factory at Coleshill.

Bournemouth. Saunders Patent Carding Machine Works Limited, Wallisdown Road. Extensions to factory.

Bradford. W. & J. Whitehead Limited. To extent their factory at Dick Lane, Laisterdyke.

Brighouse. J. C. Bottomley & Emerson Limited. The Brookfield Chemical Works is to be extended.

Brighton. West Instruments Limited, 51 Regent Street. To erect a new factory at The Hyde, Lower Bevendean.

Bristol. Regent Oil Company Limited, 117 Park Street, London E1. To build a fuel oil depot at Avonmouth Docks.

Burnley. Joseph Lucas Limited. The architects for the new factory at Eastern Avenue are Clifford Tee & Gale, 43 Frederick Road, Birmingham.

Buxton. Cintride Limited, Ecclesfield Road, Sheffield. To build new factory.

Cardiff. Westgate Engineers Limited, Collingdon Road, are to build a new factory. The architect is Kenneth Graham, 10 Churchill Road.

R. Towning Hill & Partners, 29 Great George Street, Bristol, are the architects for extensions to the works of British Oxygen Company Limited.

Coventry. Edgar Clews Limited, Torrington Avenue. Factory extensions.

Gosford Tool & Equipment Company Limited, Torrington Avenue. Factory extensions.

Dagenham. Durable Suites Limited. A new factory is to be erected at Fowler Road, Hainault industrial estate.

Daventry. Ductile Steels Limited, Willenhall. Plans have been approved for the erection of a new factory and offices.

Dewsbury. F. Gutteridge & Sons Limited, Bradford Road. Works extensions.

Ealing. Hallmark Cards (Great Britain) Limited. Extensions to factory at Rowdell Road, Northolt.

Eastbourne. Edwards Instruments Limited, Kelvin Way, Crawley. A new factory is to be built at Brampton Road.

Eccles. L. Gardner & Sons Limited, The Barton Hall Engine Works in Hardy Street is to be extended.

Enfield. Spencer, Heath & George Limited. A new factory is to be erected at Southbury Road.

Glasgow. R. A. Peacock & Son Limited are to erect a new factory on the site of the Thronliebank Print Works.

Hove. John Lancaster Radiators Limited, 44 Brunswick Street West. The architects for a new factory and offices are Morgan & Carn, 12 Grand Avenue.

Hull. Cresta Caravan Company Limited, 140 Durham Street. A new factory and offices is to be built at Reservoir Road.

Liverpool. Bradleys (Chester) Limited, City Road, Chester, are to erect a new factory in St. James' Street.

James Austin Limited, Speke Hall Road, are to build a new factory on Speke industrial estate.

Luton. Hayward Tyler & Co. Limited, Crawley Green Road, are to erect a new factory between Crawley Green Road and Kimpton Road.

Lytham. W. C. Evans & Co. Limited, Chadwick Road, Eccles, are to build a new factory on the site of the former R.A.F. railhead.

Manchester. Francis Shaw & Co. Limited, Gibbon Street. Factory extensions.

Mansfield. Maun Industries Limited, Moor Lane, are to build a new factory.

Mitcham. Morfax Limited, Willow Lane. Factory extensions.

Peterborough. Plasticasts Limited are to extend their factory at Lincoln Road, Werrington.

Rainford. James Grundy & Co. Limited, Brownlow Street, St. Helens are seeking permission to erect a new factory and offices.

Redditch. W. H. Smart & Co. Limited, Ham Market, Wrentham Street, Birmingham. Application has been made for the final stage of construction of the factory at Arthur Street.

Rundorn. A. S. M. Company, 121 Percival Lane. A new factory is to be built at Picow Farm Road.

Shipston - on - Stour. The Shipston Engineering Company Limited are to extend their works at Campden Road.

St. Albans. Record Food Products Company Limited are to extend their factory at 224 London Road.

Torquay. Jantzen Limited, Rayleigh Works, Barnstaple, are considering the erection of a new factory.

Wakefield. British Ropes Limited are to erect new workshops, etc. at Denby Dale Road.

Wednesbury. W. G. Allen Limited, 32 Hylton Street, Birmingham. Factory extensions.

Ega Electric Limited, Holyhead Road, are to extend their works.

Wolverhampton. Rotamix Concrete Limited. A new factory is to be built at Fox's Lane.

Glenrothes. Beckman Instruments Limited, manufacturers of electronic components, are planning an extension of their Queensway industrial estate factory at Glenrothes where they have been located for the past two years.

Dalmuir, Clydebank. Ingersoll Rand of Phillipsburg, New Jersey, U.S.A., are to locate a new factory beside the R.O.F. ground at Dalmuir for manufacture of compressors and drills.

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Patents For Sale or License

THE proprietor of British Patent No. 732322, entitled "Jogging Machine" offers same for license or otherwise to ensure practical wor ing in Great Britain. Inquiries to Singer, Stern & Carlberg, 140 So. Dearborn St., Chicago 3, Ill. U.S.A.

THE Proprietors of Patent No. 776655 for "Improvements in Means for Automatically Opening and Closing Doors" desire to secure commercial exploitation by License or otherwise in the United Kingdom. Replies to Haseltine Lake & Co. 28, Southampton Buildings, Chancery Lane, London WC2.

THE Proprietors of Patent No. 777853 for "Improvements in or relating to Load Hooks for Lifting" desire to secure commercial exploitation by License or otherwise in the United Kingdom. Replies to Haseltine Lake & Co. 28, Southampton Buildings, Chancery Lane, London WC2.

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THE Proprietors of Patent No. 732327 for "Improvements in or relating to valve Operating Mechanism" desire to secure commercial exploitation by License or otherwise in the United Kingdom. Replies to Haseltine Lake & Co. 28, Southampton Buildings, Chancery Lane, London WC2.

THE proprietor of British Patent No. 603659, entitled "Power-lift attachment for tractors", offers same for license or otherwise to ensure practical working in Great Britain. Inquiries to Singer, Stern & Carlberg, 140 S. Dearborn Street, Chicago 3, Illinois, U.S.A.

THE proprietor of British Patent No. 750963, entitled "Improvements in gauging apparatus for use in machining and grinding operations" offers same for license or otherwise to ensure pracitcal working in Great Britain. Inquiries to Singer, Stern & Carlberg, 140 S. Dearborn Street, Chicago 3, Illinois, U.S.A.

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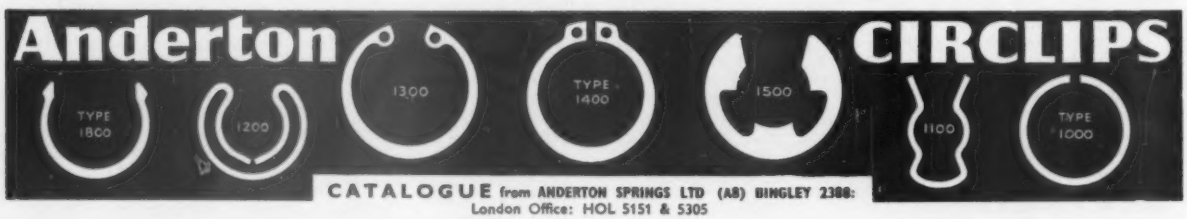

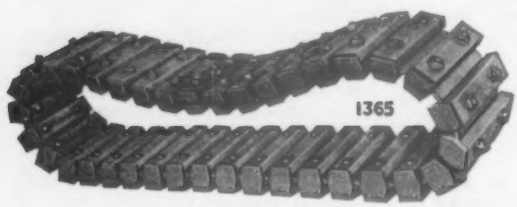

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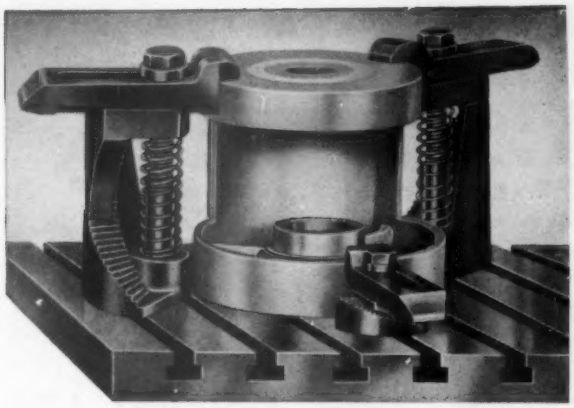

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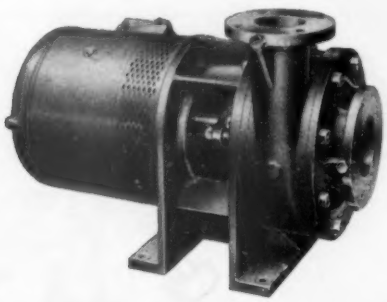

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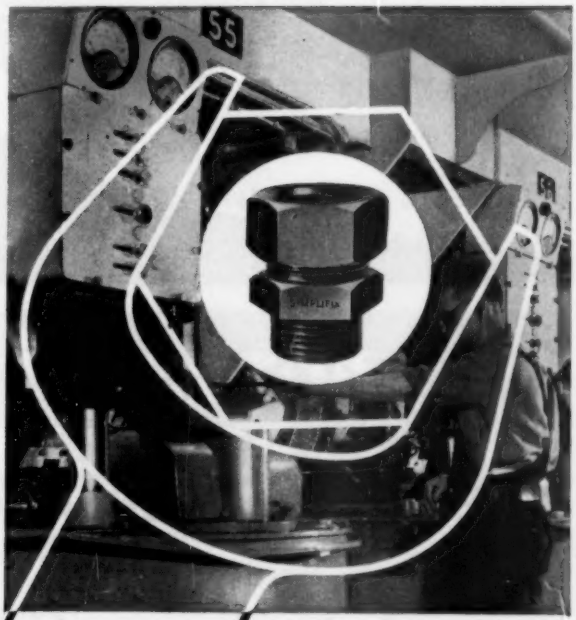

The illustration shows centrifugal machines at the Plaistow Wharf Sugar Refinery of Tate and Lyle Ltd., where large numbers of Simplifix couplings are used

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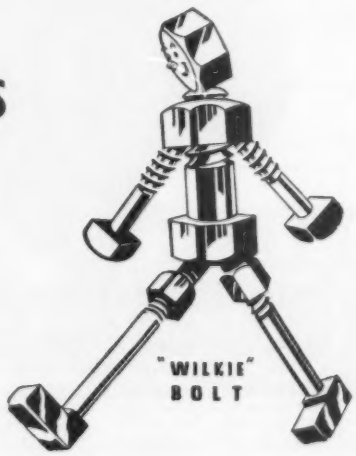

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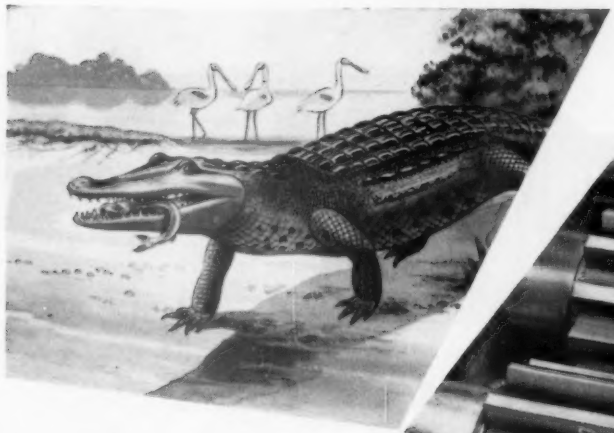

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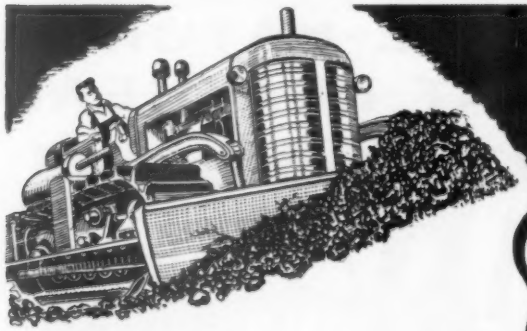

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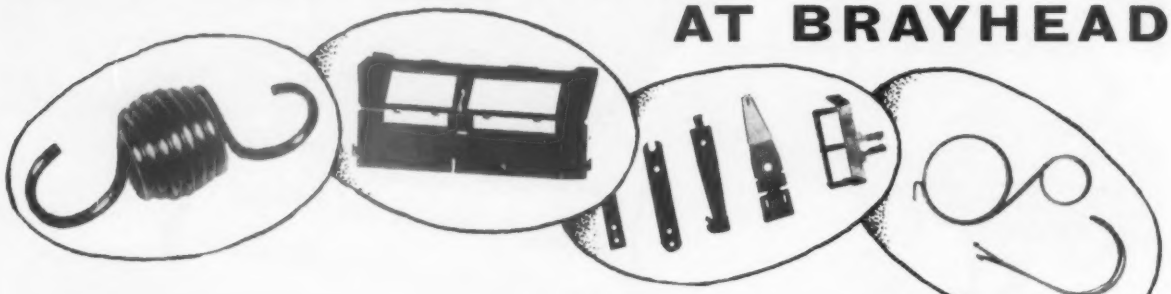

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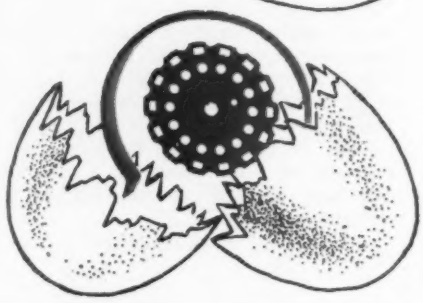

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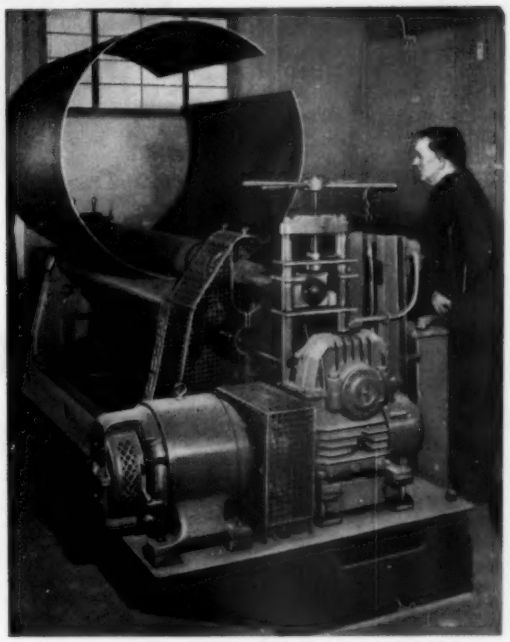

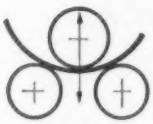

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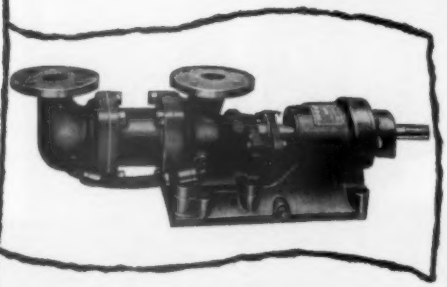

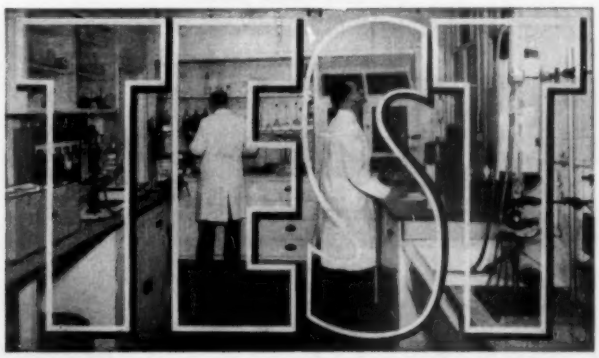

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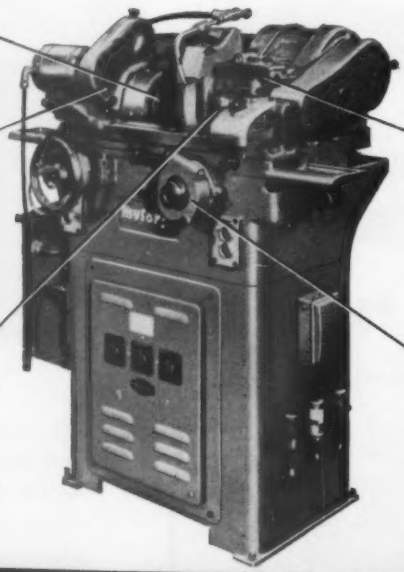

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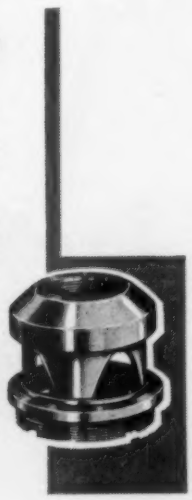

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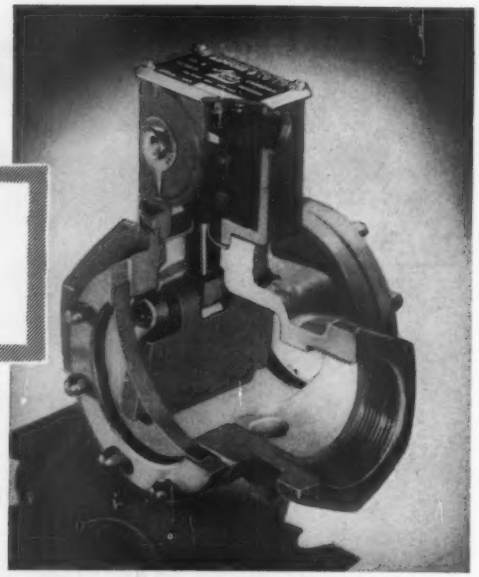

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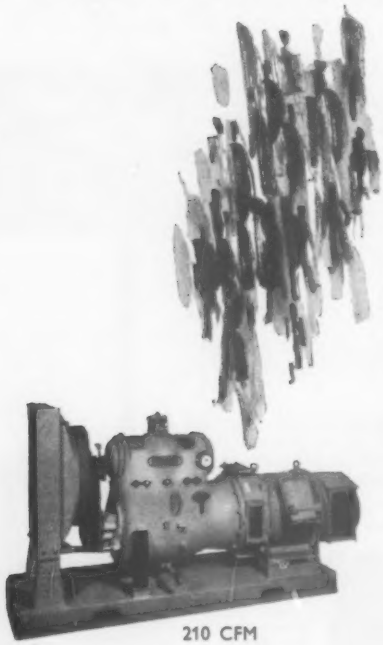

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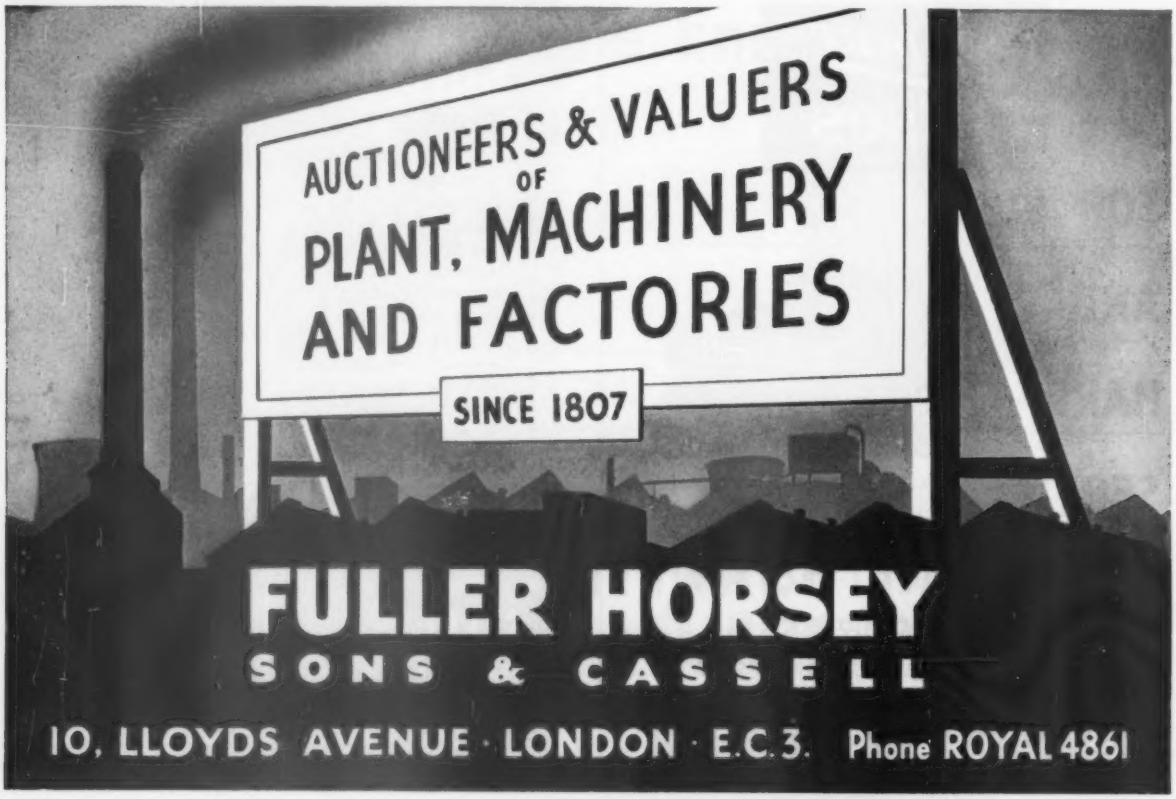

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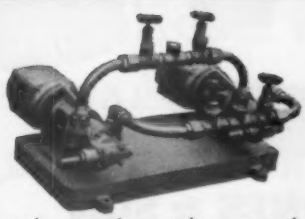

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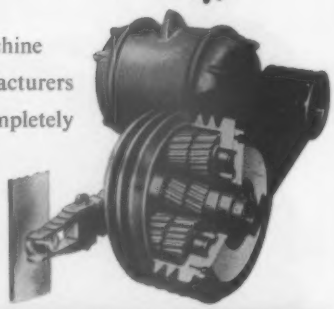

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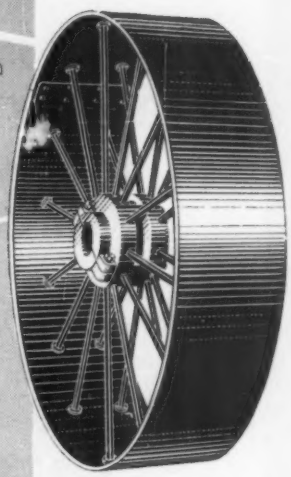

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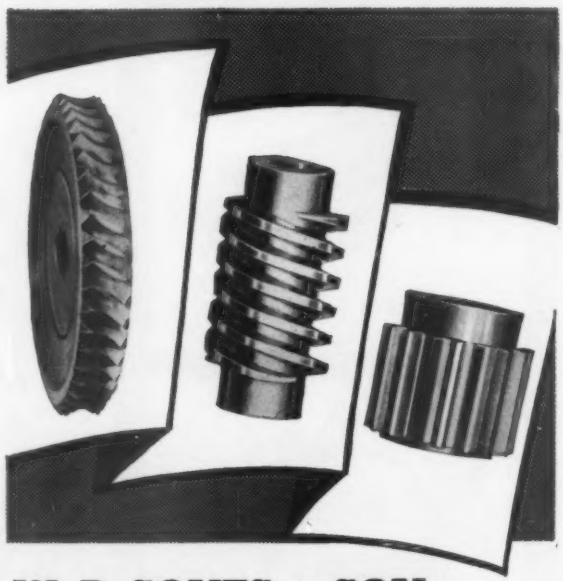

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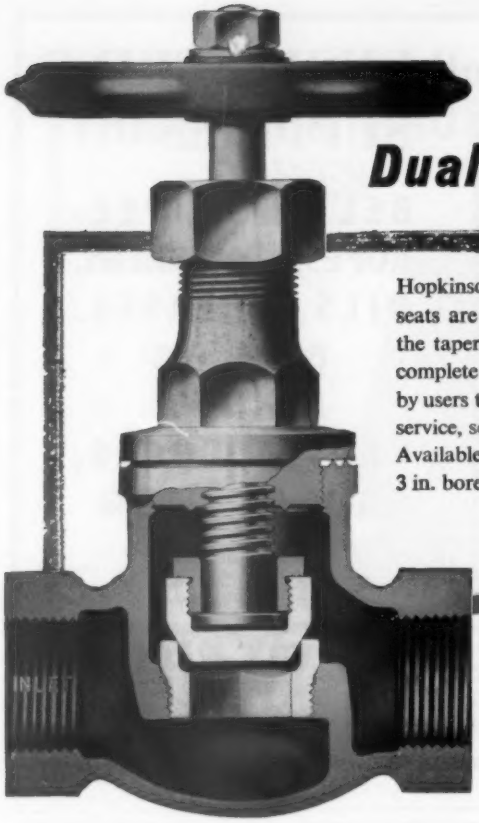

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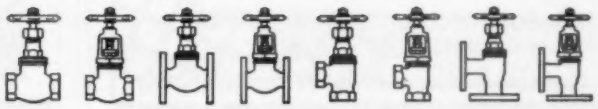

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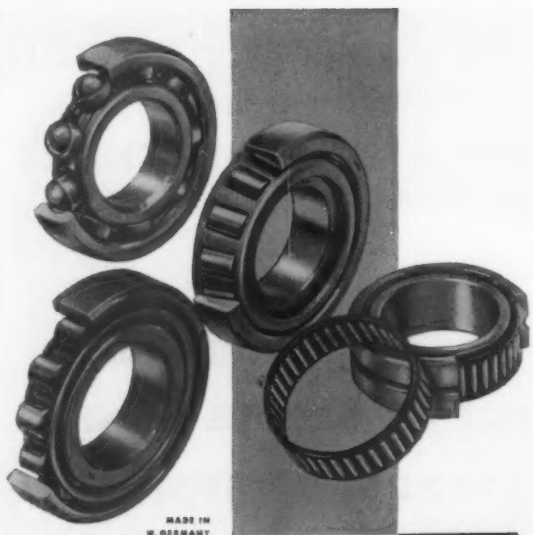

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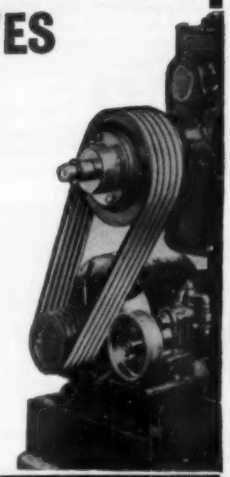

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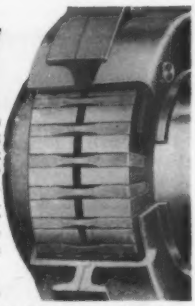

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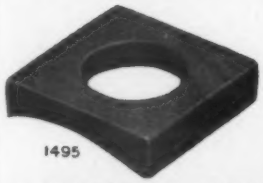

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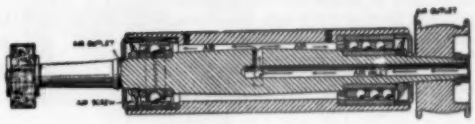

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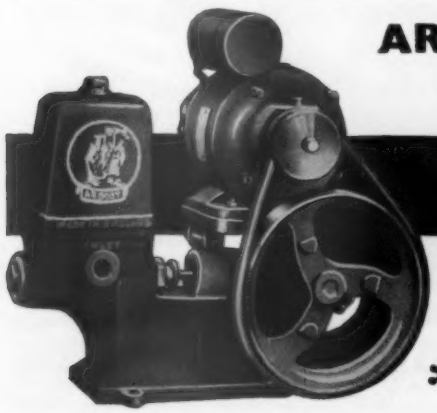

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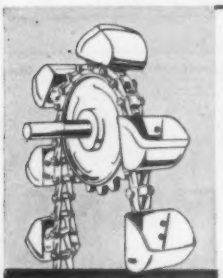

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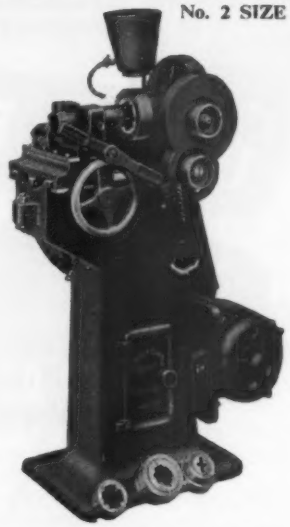

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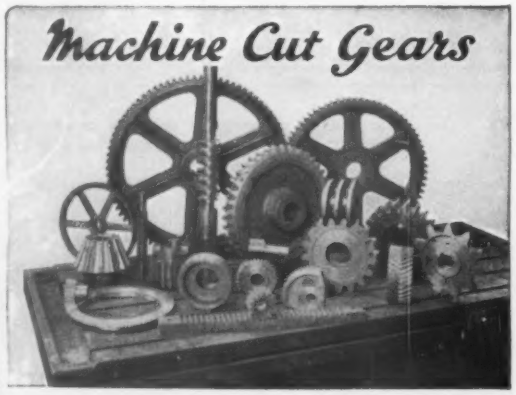

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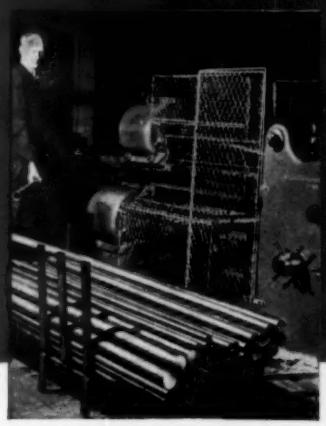

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